ELECTRICAL REVIEW

FRIDAY
NOVEMBER 1960

WEEKLY
PRICE 1s 6d

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Vol 167-22

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Aberdare Cables

*Aberdare Cables Ltd manufacture
a comprehensive range of paper insulated and
thermoplastic cables; to British Standard or
foreign specifications as required.*

ERDARE CABLES LIMITED ABERDARE GLAMORGAN

London Office: 19 Woburn Place London WC1 TERminus 2777

TGA AC5

MEM introduce a new range of 500 volt SWITCHGEAR

CHROME PLATED FRONT OPERATING SWITCH HANDLES

FABRICATED STEEL ENCLOSURES

SEMI-ENCLOSED REWIRABLE OR H.R.C. CARTRIDGE FUSES

15, 30, 60, 100 AMPS

'EXEL'

SWITCHES AND SWITCHFUSES

- Fabricated cases are of heavy gauge sheet steel with hinged covers, rustproofed and finished grey stove enamel.
- The "Exel" range is fitted with chrome plated front operating switch handles, a feature which permits more compact assemblies on switchboards or panels.
- The "ON" and "OFF" positions are clearly shown by an indicator associated with the switch handle.
- Fuse bases are of the new "Kantark-Exel" pattern, which will accept semi-enclosed rewirable or H.R.C. cartridge fuse carriers.
- M.E.M. H.R.C. cartridge fuse carriers are designed to accommodate H.R.C. cartridge fuse-links to B.S.88:1952, Appendix 'J' Dimensions, Form A—Offset Tags.
- M.E.M. H.R.C. cartridge fuse-links are available for use with this range of switchgear, and have been A.S.T.A. certified for Category of Duty 440 AC3 (16,500 amps), 440 AC4 (33,000 amps) and 440 AC5 (46,000 amps).
- "Exel" switches comply with the relevant Temperature Rise, and Making and Breaking Capacity Tests of B.S.861: Part 1, 1955, and switchfuses with B.S.2510:1954.

. . . and so many other features, too

Write for M.E.M. List No. 450

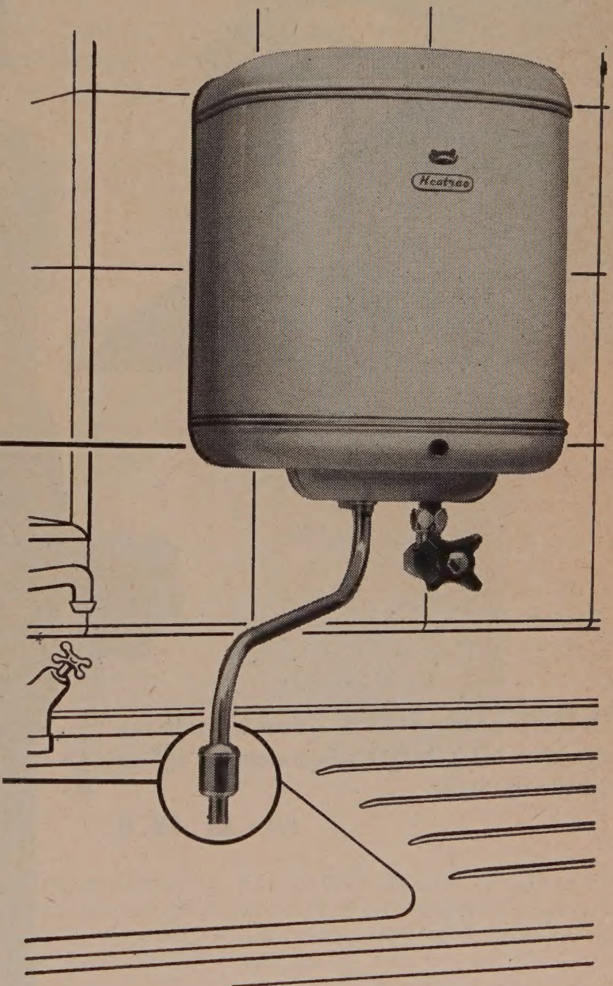
MEM

MIDLAND ELECTRIC MANUFACTURING CO. LTD., REDDINGS LANE,
TYSELEY, BIRMINGHAM 11.

AN OUTSTANDING ACHIEVEMENT IN WATER HEATING

Heatrae Lido 'Express'

the most up-to-date AUTOMATIC ELECTRIC SINK WATER HEATER



Never before has such value, performance, style and craftsmanship been embodied in an automatic sink water heater. The classic styling of the Lido Express will grace any kitchen—and it will maintain its spotless appearance indefinitely.

2 UNIQUE FEATURES

- THE ECONOMY EYE *gives visual indication of when the current is 'on'—and proof of the low running cost.*
- SPECIAL DISPENSER END *to outlet spout gives complete flow control and instant cut-off on closing the valve.*

A special high-efficiency heating element is incorporated, which provides a continuous supply of piping hot water up to a maximum of *9 GALLONS PER HOUR. Diluted with cold, this means approximately 18 gallons at washing-up temperature—adequate for most average households.**

Colours: White or Cream
Loading: 3kW or 2kW
Voltage: 200/220 or 230/250 A.C. only

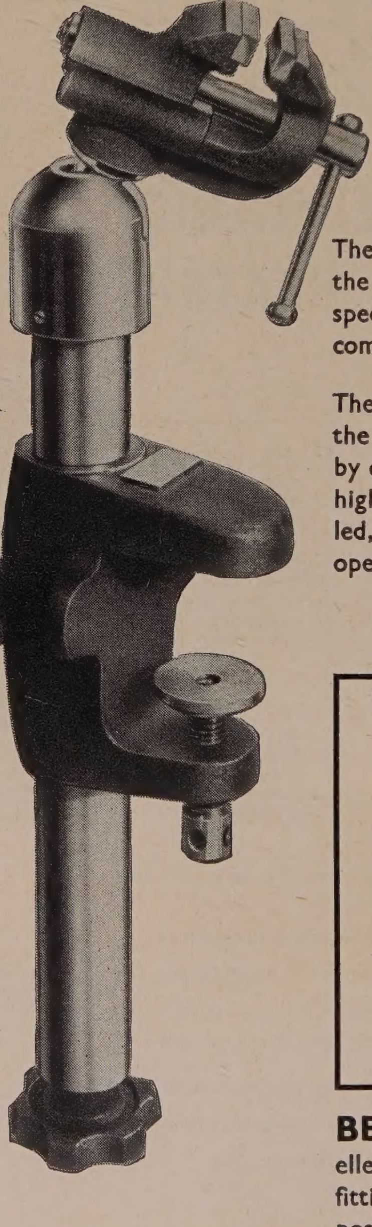
** 6 gallons with 2kW Loading*

Write today for
LEAFLET No. 92

HEATRAE LTD
NORWICH · NORFOLK · NOR 29A · ENGLAND
Telephone: NORWICH 25131 *Telegrams:* HEATRAE NORWICH

greater output—less fatigue—with this

OFFEN universal action vice

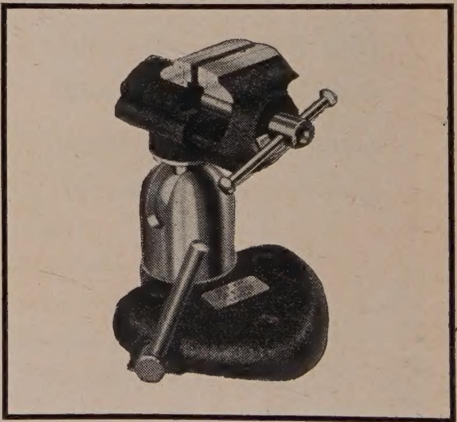


The Offen Universal Angle Vice enables the operator to handle delicate work on specialised parts or wiring, etc., with comfort and quick efficiency.

The vice head swivels through 90° and the turret 360°, both being firmly locked by one clamping bar. Construction is of high-grade iron castings, stove enamelled, with ground jaws of 1⅝″ width opening to 1⅛″, and enclosed leadscrew.

PEDESTAL TYPE—clamps to bench edge and has a height adjustment of 6⅝″ to suit the operator.

Price **£9. 10. 0**



BENCH TYPE—has a stove enamelled base with three fixing points, for fitting permanently in any convenient position.

Price **£6. 12. 6**

OFFEN TOOLS

universal in action and use

AYLING INDUSTRIES GROUP

Obtainable from leading factors or direct from

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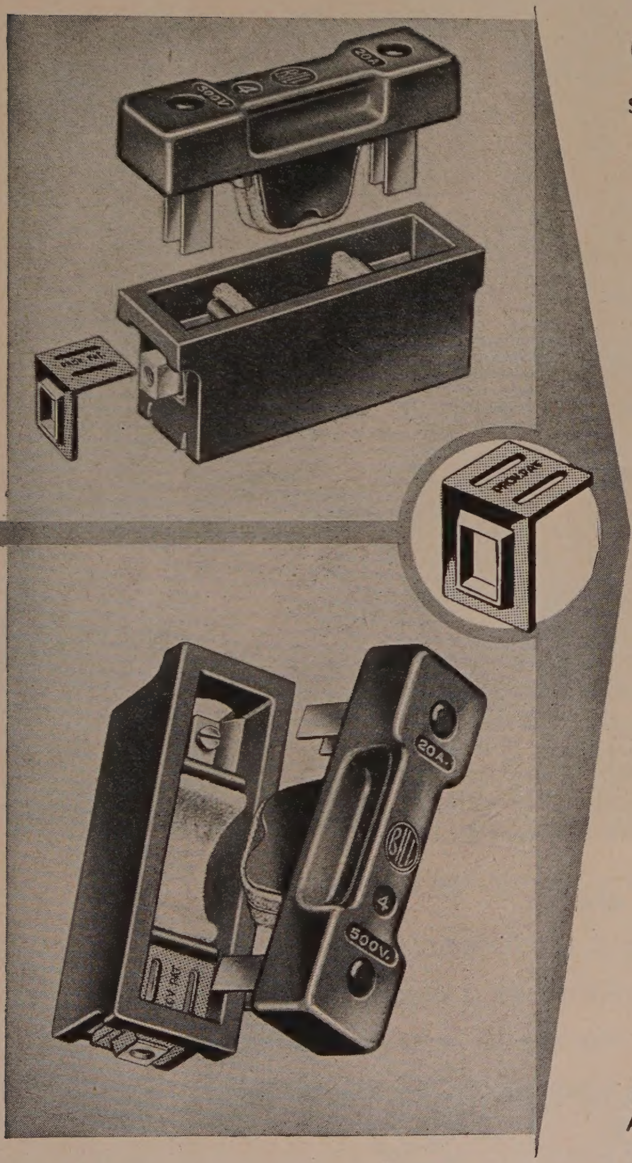
HAMBLING INDUSTRIES LTD., Industrial Estate, Terminus Rd., Chichester, Sussex.

Southern Area Distributors:-V. Huffam Ltd., Temple Fortune Works, 1-2 Bridge Lane, London, N.W.11.

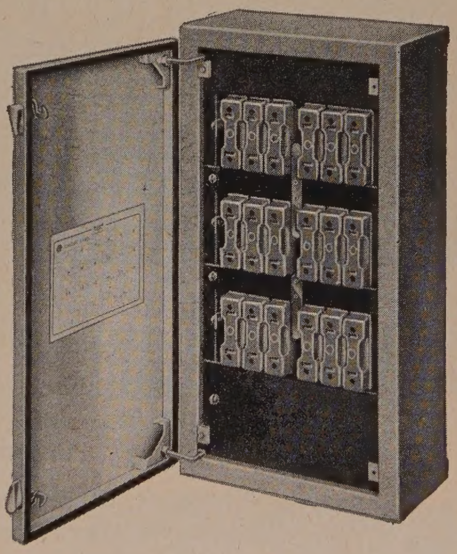
You cannot buy better gear

SAFETY BILL SHIELDS



BILL ARC DAMPING TYPE OR H.R.C. DISTRIBUTION FUSEBOARDS ARE NOW FITTED WITH THE BILL SAFETY SHIELDS (PROV. PAT.) AS ILLUSTRATED.

FUSEBOARDS ARE AVAILABLE WITH NO PRICE INCREASE IN ALL SIZES OF 15/20 AMP. AND 30 AMP. RATINGS.



THE INTRODUCTION OF PROTECTIVE SHIELDS FITTED OVER THE LIVE CONTACT ENDS IN THE FUSE BASES GIVES ADEQUATE PROTECTION AGAINST ACCIDENTAL CONTACT WHEN THE FUSE CARRIERS ARE WITHDRAWN.

THE SHIELDS ARE STRONG DURABLE MOULDED NYLON AND FORM AN INTEGRAL PART OF THE BUSBAR FUSE CONTACT ASSEMBLY AND CANNOT ACCIDENTALLY BECOME DETACHED.

BILL SWITCHGEAR LTD
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CHURCH LANE

LEEDS, 14.
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G. SUTTON,
WOODLANDS FACTORY.

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HIGH ST.

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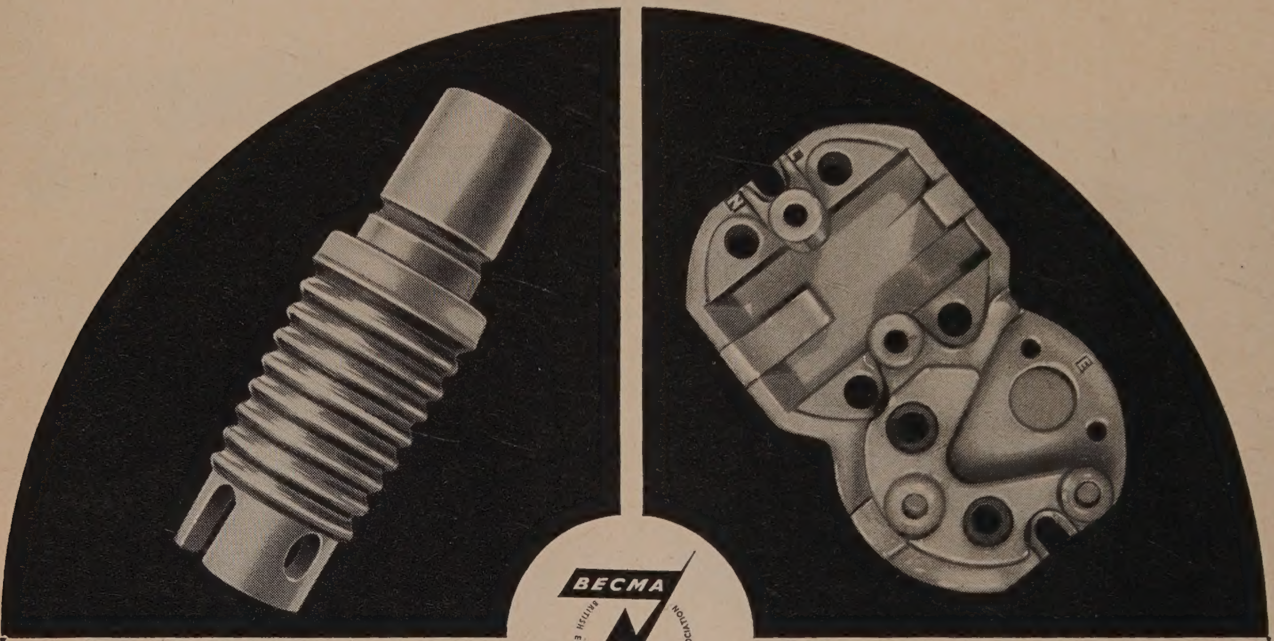
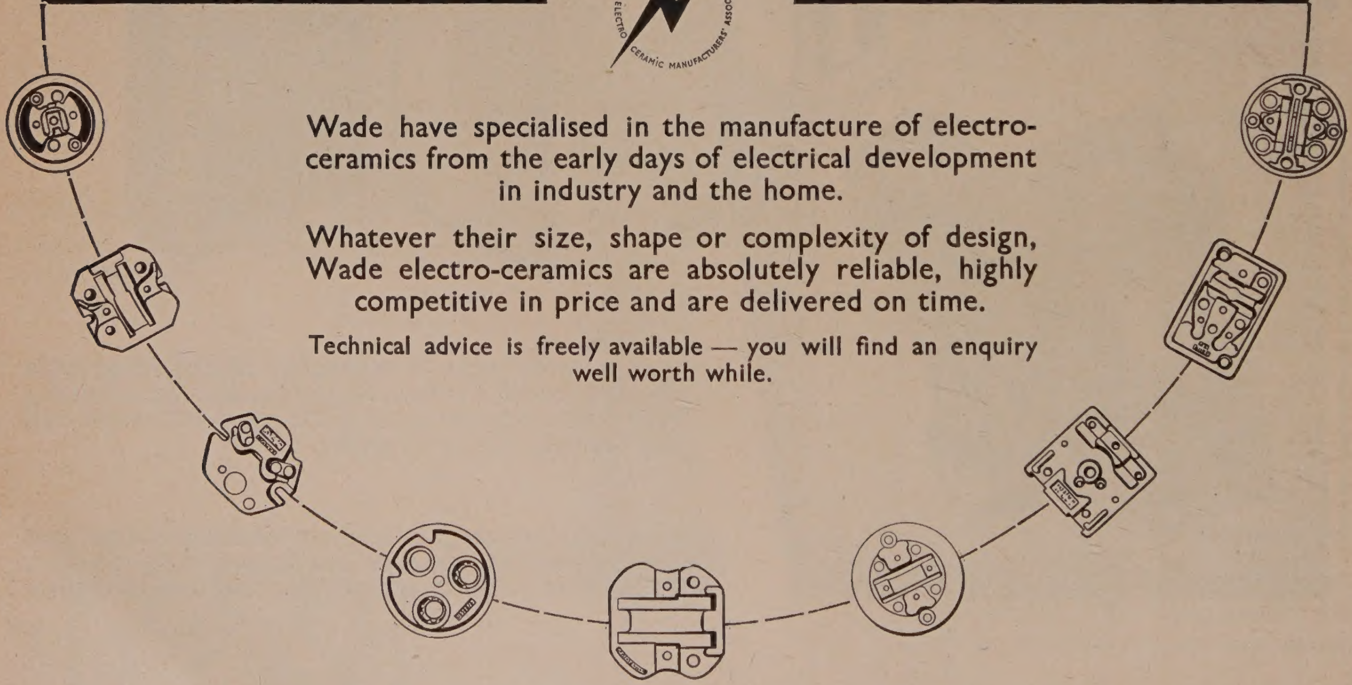
WADE

ELECTRO-CERAMICS



BECMA
BRITISH ELECTRO CERAMIC MANUFACTURERS' ASSOCIATION



Wade have specialised in the manufacture of electro-ceramics from the early days of electrical development in industry and the home.

Whatever their size, shape or complexity of design, Wade electro-ceramics are absolutely reliable, highly competitive in price and are delivered on time.

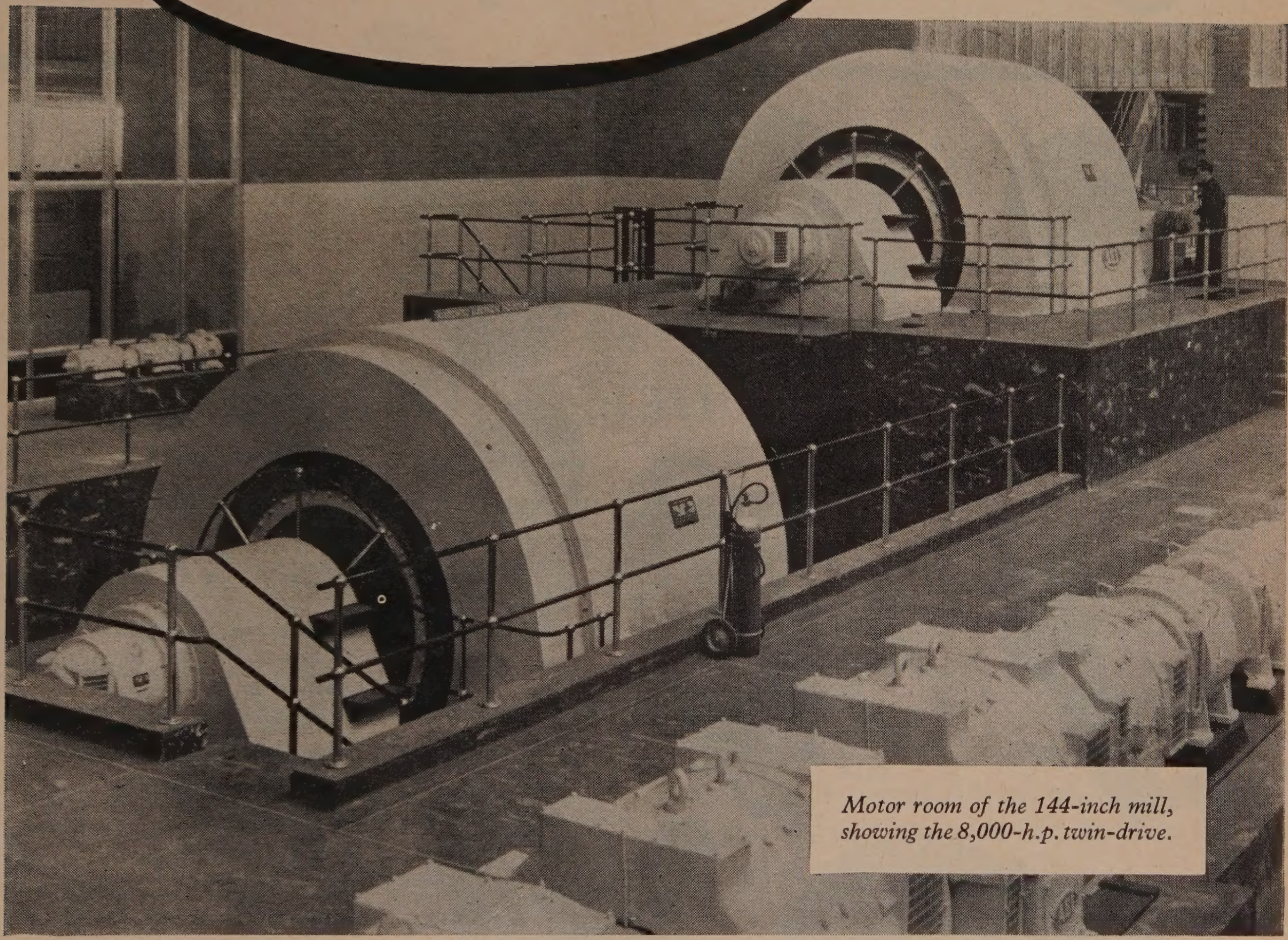
Technical advice is freely available — you will find an enquiry well worth while.

PORCELAIN FOR INSULATION.....WADE FOR PORCELAIN

GEORGE WADE & SON LTD., BURSLEM, STOKE-ON-TRENT
WADE (ULSTER) LTD., PORTADOWN, NORTHERN IRELAND

Members of the WADE *Group of Potteries*

AEI at ROGERSTONE



Motor room of the 144-inch mill, showing the 8,000-h.p. twin-drive.

For the expansion scheme at Rogerstone Works, AEI have supplied to Alcan Industries Limited (formerly Northern Aluminium Co. Ltd.) all the electrical equipment for the new 144-inch hot reversing mill and for the modernisation and enlargement of the 88-inch hot-finishing mill.

AEI

Associated Electrical Industries Limited

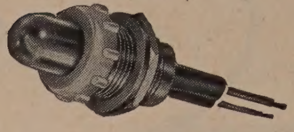
Heavy Plant Division

RUGBY, ENGLAND

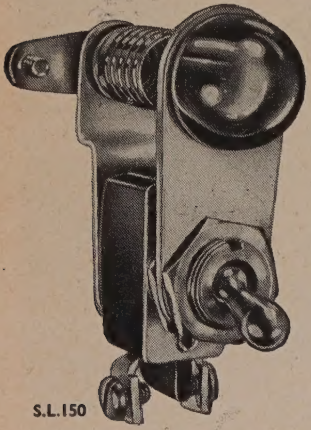
A5597

Arcolectric Signal Lamps

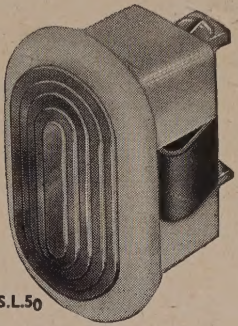
S.L.162



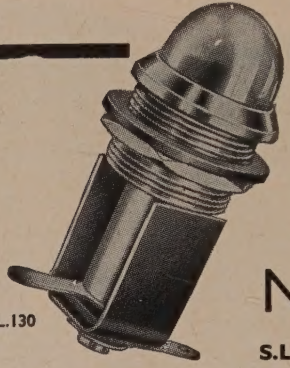
S.L.160



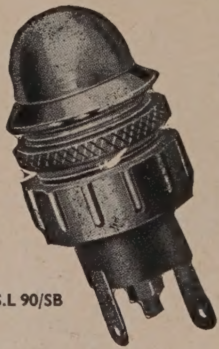
S.L.150



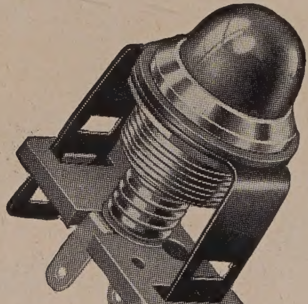
S.L.50



S.L.130

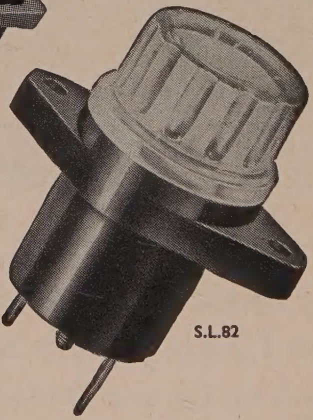


S.L 90/SB

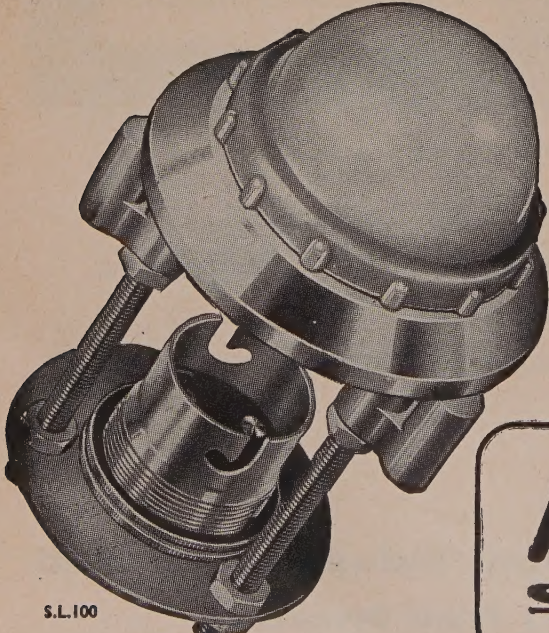


S.L.135

S.L.86



S.L.82



S.L.100

Neon for 80—600 volts

S.L.162 and S.L.160 : New miniature low cost neon signal lamps. ½" hole fixing. Completely sealed against moisture.

S.L.50 : Snap-in fixing.

Low Voltage

S.L.130 : New high quality design for M.B.C. (M.C.C.) bulbs. Also available with M.B.C. neon.

S.L.90/SB : Popular M.E.S. holder. Services No. 10AE/413.

S.L.135 : Adjustable M.E.S. holder.

S.L.150 : Combined toggle switch and M.E.S. signal lamp.

S.L.82 : M.E.S. holder ZA 4201.

S.L.86 : Low cost M.E.S. holder.

Mains

S.L.100 : For 15 watt B.C. sign lamps.

A similar but smaller S.B.C. holder is available for S.B.C. 10 watt lamps.

Write for Catalogue No. 132

ARCOLECTRIC SWITCHES · LTD

CENTRAL AVENUE · WEST MOLESEY · SURREY · Tel.: MOLESEY 3232

Save stand-by battery space with the new **CHLORIDE** Stationary Cell

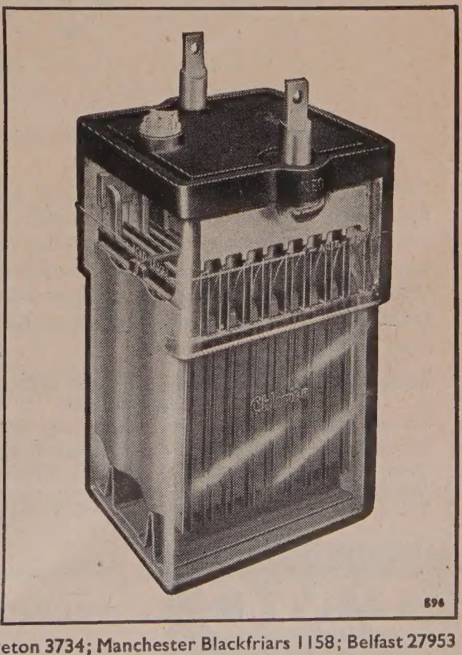
This light, robust cell, with its Planté positive and pasted negative plates, Porvic microporous separators and many other improvements in material and design, saves up to 50% of previously necessary battery space—yet performs its duties with greater efficiency and complete reliability. Specially designed for stand-by duties entailing discharge rates between, say, the 3-hour and the very high rates demanded for switch-closing purposes, it is ideal for trickle-charge operation and has all the remarkable length of life associated with the Planté type of construction.

The field in which the new cell is designed to replace current Planté types is a very wide one. Emergency lighting*, switch operation and emergency supply in hospitals, theatres, cinemas and other public buildings, nuclear and conventional power stations, all rely on trickle-charged batteries. In Great Britain today such batteries occupy millions of cubic feet of valuable space. The new Chloride cell could free almost half of it.

**The new cell will from now onwards be fitted in all Keepalite units—the Chloride Company's automatic emergency lighting system.*

A PRODUCT OF CHLORIDE BATTERIES LIMITED
BACKED BY WORLD-WIDE SERVICE

Makers of Exide Batteries



Enquiries to: London Elgar 7991; Bristol 664086; West Bromwich 2361; Leeds 20248; Glasgow, Bridgeton 3734; Manchester Blackfriars 1158; Belfast 27953

But, nevertheless, close examination will reveal many of their superior qualities. And by using them you'll see, too, that they offer decided advantages in every aspect of industrial control involving electrical and electronic equipment. Where space is limited, their choice is destined to become a matter of course. *The wide range is capable of handling power from microwatts to kilowatts.*

BOTH ILLUSTRATIONS ARE OF THE TMC ZETTLER RELAY TYPE AZ210
(Actual size)

Exceptionally small · Robust · Screwless construction · 4 change-over actions · Fast speeds · Card operated springs · A general purpose Relay of outstanding merits · Available with printed circuit to suit British 0.1″ Matrix.

THERE ARE TMC ZETTLER RELAYS WITH THESE FEATURES:

- ✳ Gold flashed contacts to give maximum reliability
- ✳ Injection moulded nylon lifting pins to give high stability
- ✳ A wide range of operating coils
- ✳ Plastic covers for protection in transit and to keep out the dust when installed
- ✳ Mercury tubes for switching large loads
- ✳ Latching features
- ✳ Twinned contacts
- ✳ To MIL specifications as used by NATO

TMC

Write now for further information: Relay Division, I
TELEPHONE MANUFACTURING COMPANY LIMITED
Hollingsworth Works, London SE21 · Telephone: GIPsy Hill 2211

Automatic sequence timing

Elcontrol Timers for process and machine control include:-

PROCESS TIMERS

which start a process on closing the initiating switch, and stop it at the end of the time interval.

DELAY SWITCHES

which start or stop a process at the end of the time interval.

CYCLIC TIMERS

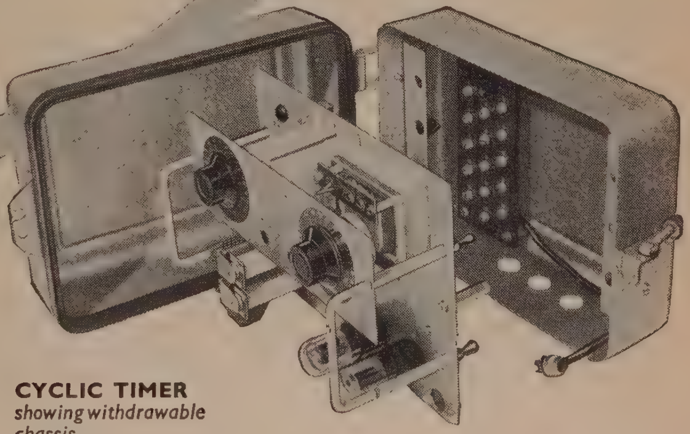
which automatically repeat a process at pre-determined intervals.

SEQUENCE TIMERS

which give full programming of complex processes embodying a number of timing stages.

The new ***TRU3 TIMER*** *or Delay Switch £14.*

A complete sequence control panel for Diecasting Machine control.



CYCLIC TIMER
showing withdrawable chassis.

Repetitive accuracy of standard units is within ±2%, and a special high accuracy timer is available which betters ±0.1%.

Standard Timing Ranges cover between them 0.1 to 300 seconds.

Prices range from £14 upwards.

Elcontrol Timers are widely used on Resistance Welding Machines, Foundry Machines, Diecasting Machines, Filling Machines, Conveyors, Testing Equipment, Distillation Plant, Machine Tools and Process Plant throughout industry.

We shall be glad to advise on the use of Standard Timers or Special Control Systems for particular applications.

ELCONTROL *electronic control systems*

Regd Trade Mark

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Telephone: Hitchin 2411

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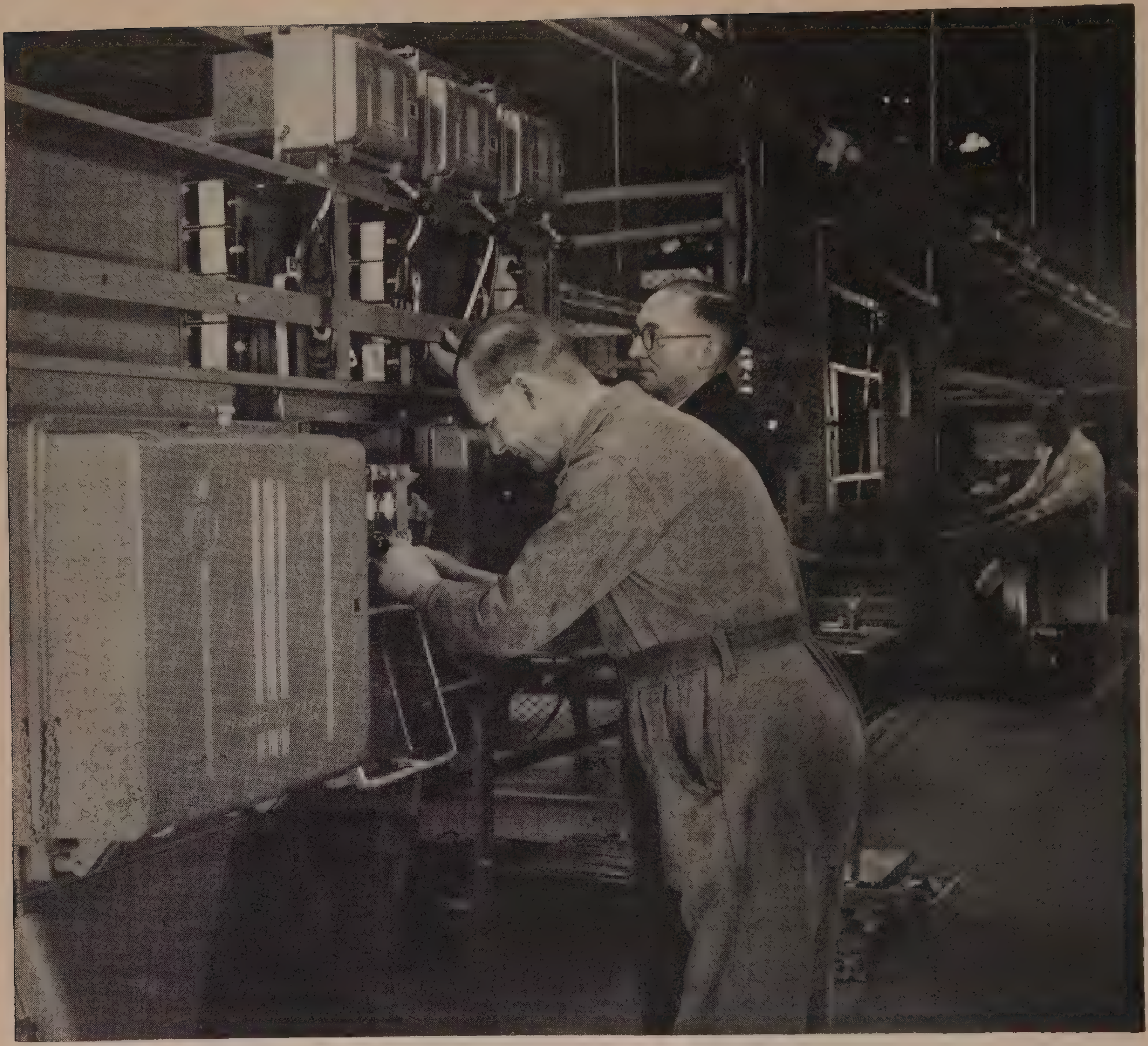

Whichever way you look at it

Whichever way you look at it, SANDACLAD Switchgear is 'just the job'. Perfect as can be in conception, design and manufacture it bears the unmistakable stamp of quality. From our point of view, SANDACLAD Switchgear —indeed, every Sanders product—embodies the best of modern techniques both in design and fabrication. For the electrician SANDACLAD Switchgear offers the simplicity of speedy, easy wiring and the elimination of time-wasting frustrating re-adjustments. And the user can have complete confidence in the capability of SANDACLAD Switchgear to perform its allotted task and to carry its designated loading. Dependable, reliable and as pleasing in appearance as such equipment can be, SANDACLAD Switchgear provides safe, immediate and lasting control of electrical power.

SANDACLAD SWITCHGEAR IS RIGHT IN EVERY ASPECT

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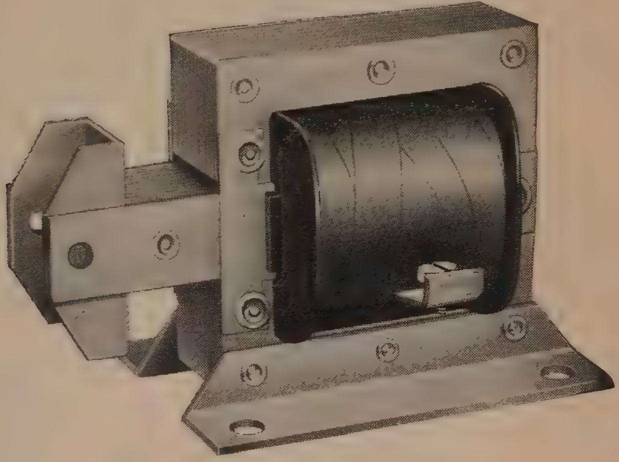
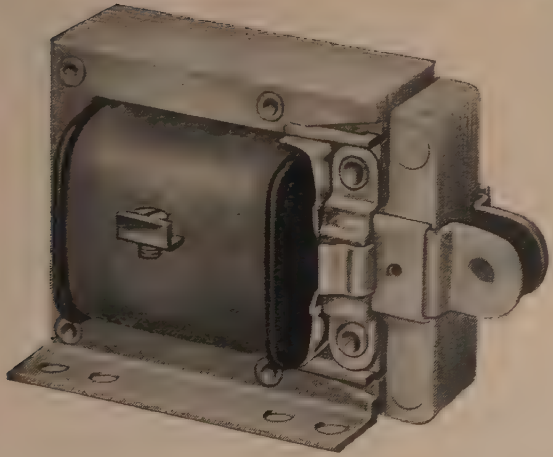
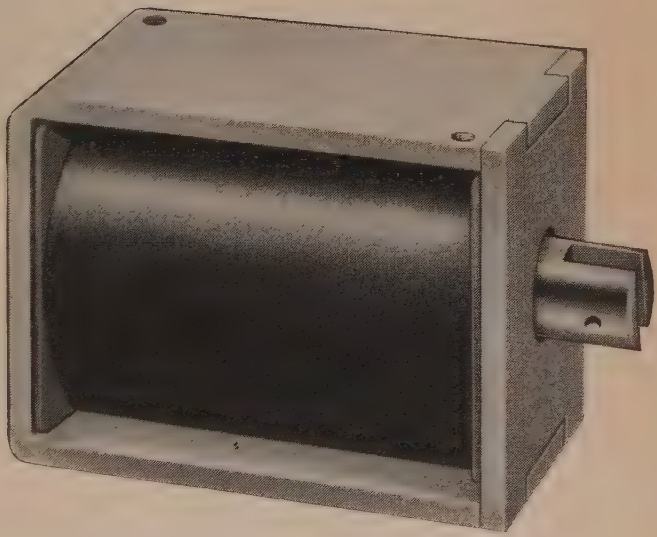
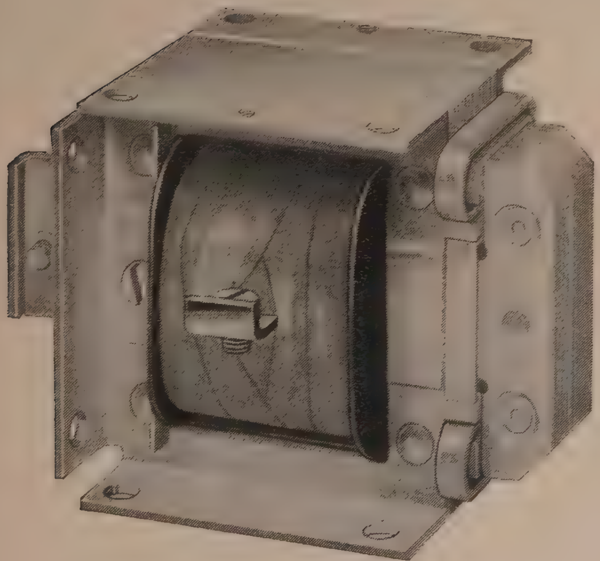
ELECTRO METHODS LTD









A FULL RANGE OF A.C. & D.C. SOLENOIDS

PROMPT DELIVERY

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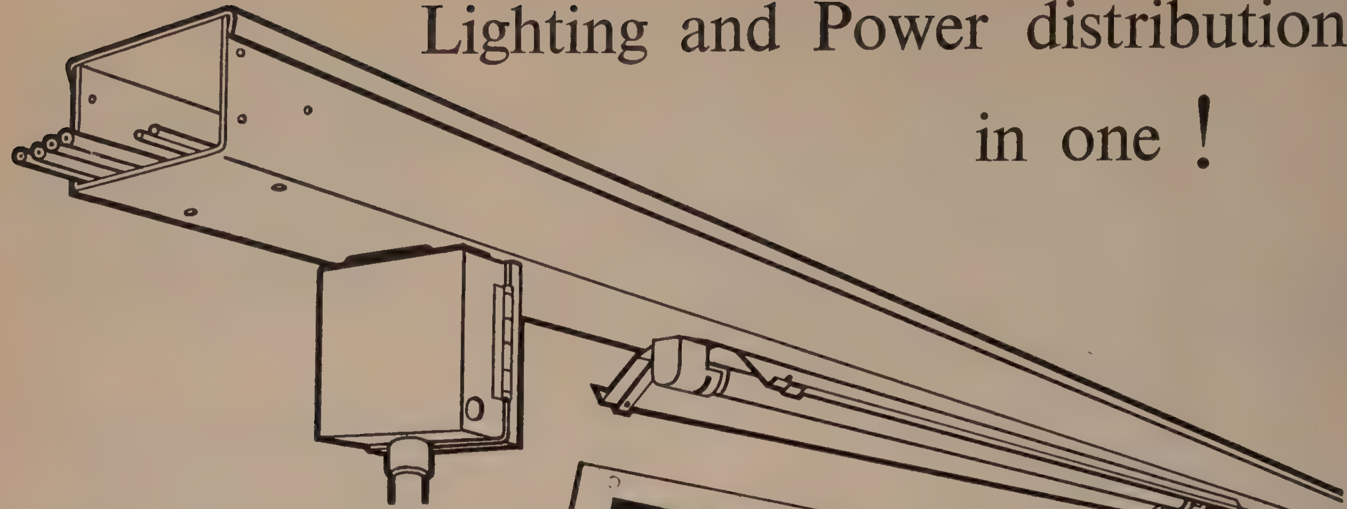
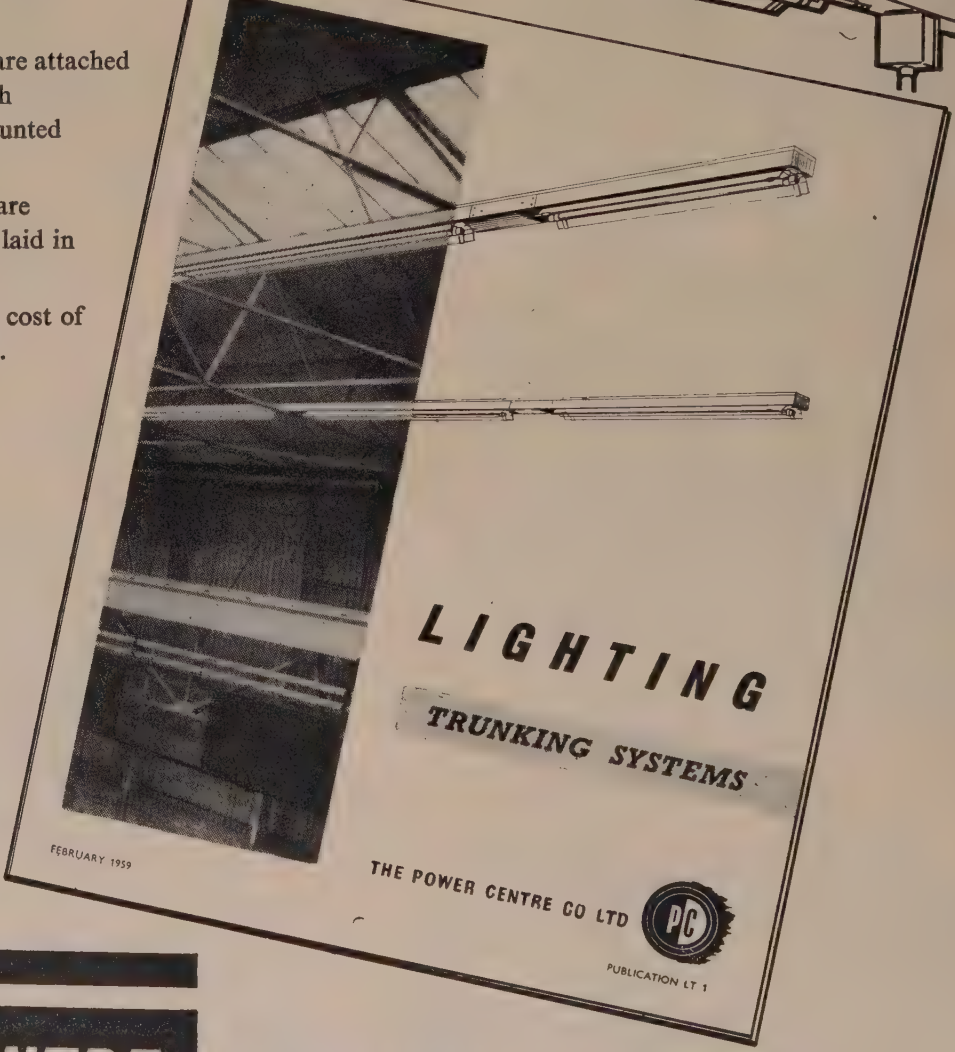
Lighting and Power distribution in one !





LIGHTING

TRUNKING SYSTEMS

FEBRUARY 1959

THE POWER CENTRE CO LTD

PC

PUBLICATION LT 1

Fluorescent lighting fittings are attached to underside of trunking with appropriate control gear mounted inside the trunk.

Additionally, tap-off points are provided from power cables laid in the trunking.

Quality of purpose that cuts cost of material, time of installation.

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Send for informative literature !

PC

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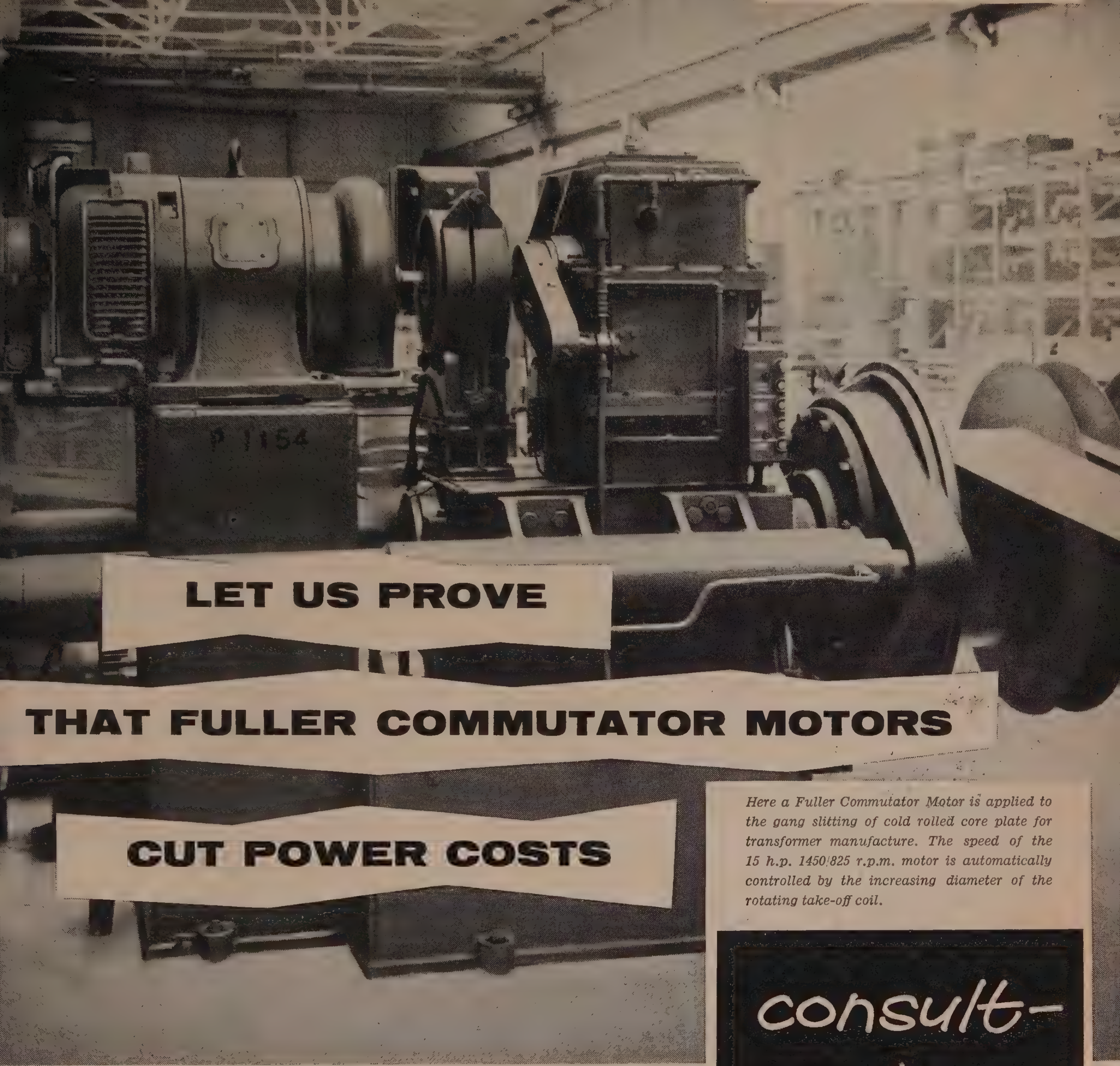

LET US PROVE THAT FULLER COMMUTATOR MOTORS CUT POWER COSTS

Here a Fuller Commutator Motor is applied to the gang slitting of cold rolled core plate for transformer manufacture. The speed of the 15 h.p. 1450/825 r.p.m. motor is automatically controlled by the increasing diameter of the rotating take-off coil.

All industrial processes differ but optimum output is a consideration common to all. The *INFINITE variable speed* characteristic of the Fuller A.C. Commutator Motor means that your machine can be operated at *precisely the exact speed* to give maximum output of quality and quantity. The speed required is maintained irrespective of normal load variation. Commutator Motors require no resistance or external regulator; current consumption is reduced at lower speeds bringing savings in power costs. We shall be glad to explain how your factory can benefit by using Fuller Commutator Motors.

consult-

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Sole U.K. representatives for ASEA Sweden
FULLER ELECTRIC LIMITED
FULBOURNE ROAD · LONDON E.17
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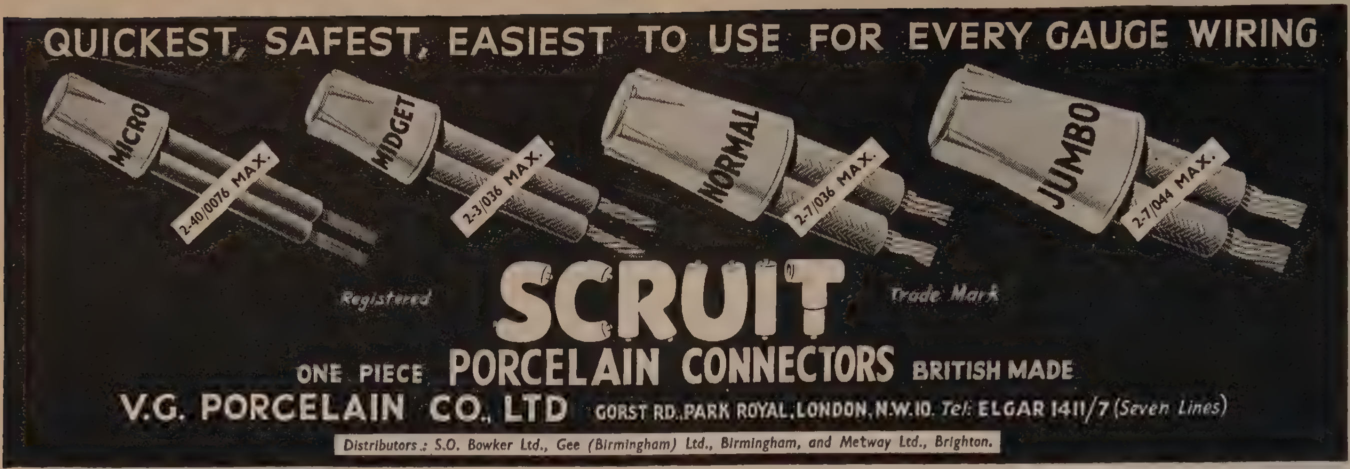
Also at Birmingham, Glasgow and Manchester



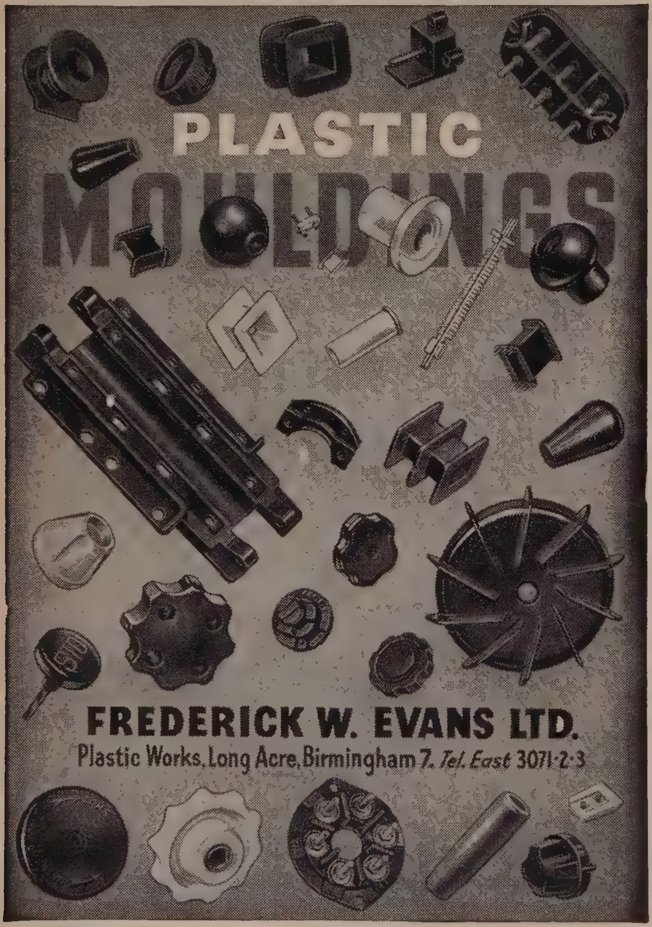
QUICKEST, SAFEST, EASIEST TO USE FOR EVERY GAUGE WIRING

Registered **SCRUIT** Trade Mark

ONE PIECE PORCELAIN CONNECTORS BRITISH MADE

V.G. PORCELAIN CO., LTD GORST RD., PARK ROYAL, LONDON, N.W.10. *Tel:* ELGAR 1411/7 (*Seven Lines*)

Distributors: S.O. Bowker Ltd., Gee (Birmingham) Ltd., Birmingham, and Metway Ltd., Brighton.



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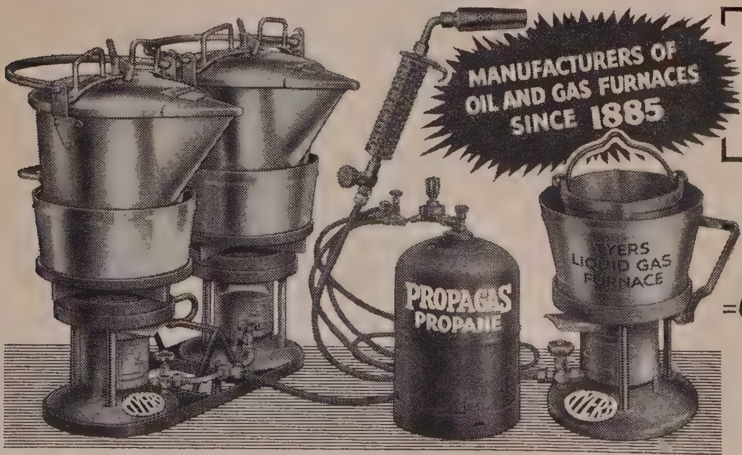

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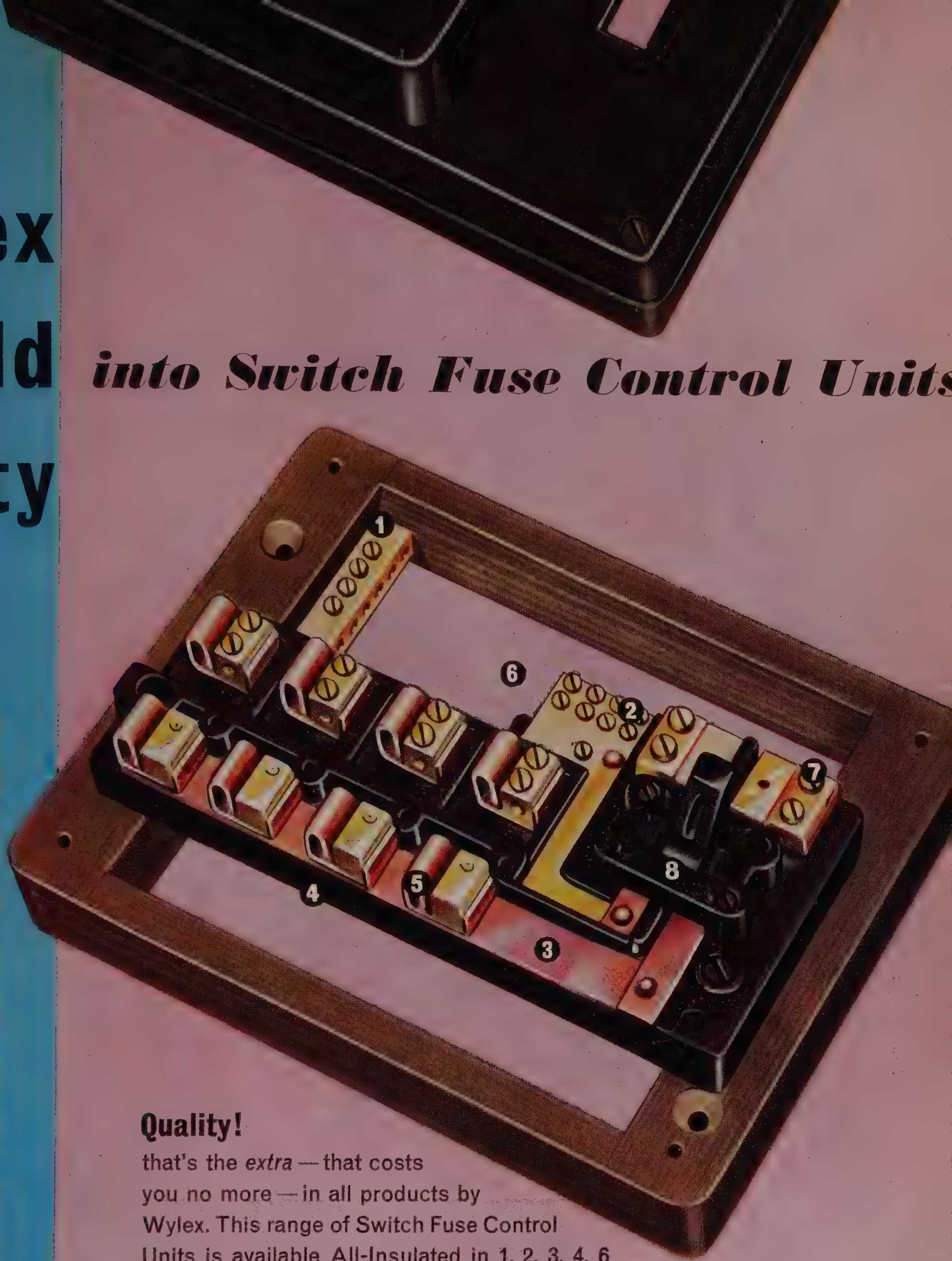

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- ⑤ Fuse Contact Clips of Special design to ensure positive contact.
- ⑥ Ample wiring room.
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- ⑧ Incorporates WYLEX Switch — proven by years of extensive service.

Quality!

that's the *extra* — that costs you no more — in all products by Wylex. This range of Switch Fuse Control Units is available All-Insulated in 1, 2, 3, 4, 6 and 8 way and Metalclad 3, 4, 6 and 8 way, 250v. S.P.&N. Especially easy to stock and make up, to any combination of fuses — rewirable or cartridge. Features the *proven* WYLEX switch with silver-to-silver contacts and sturdy mechanical components.

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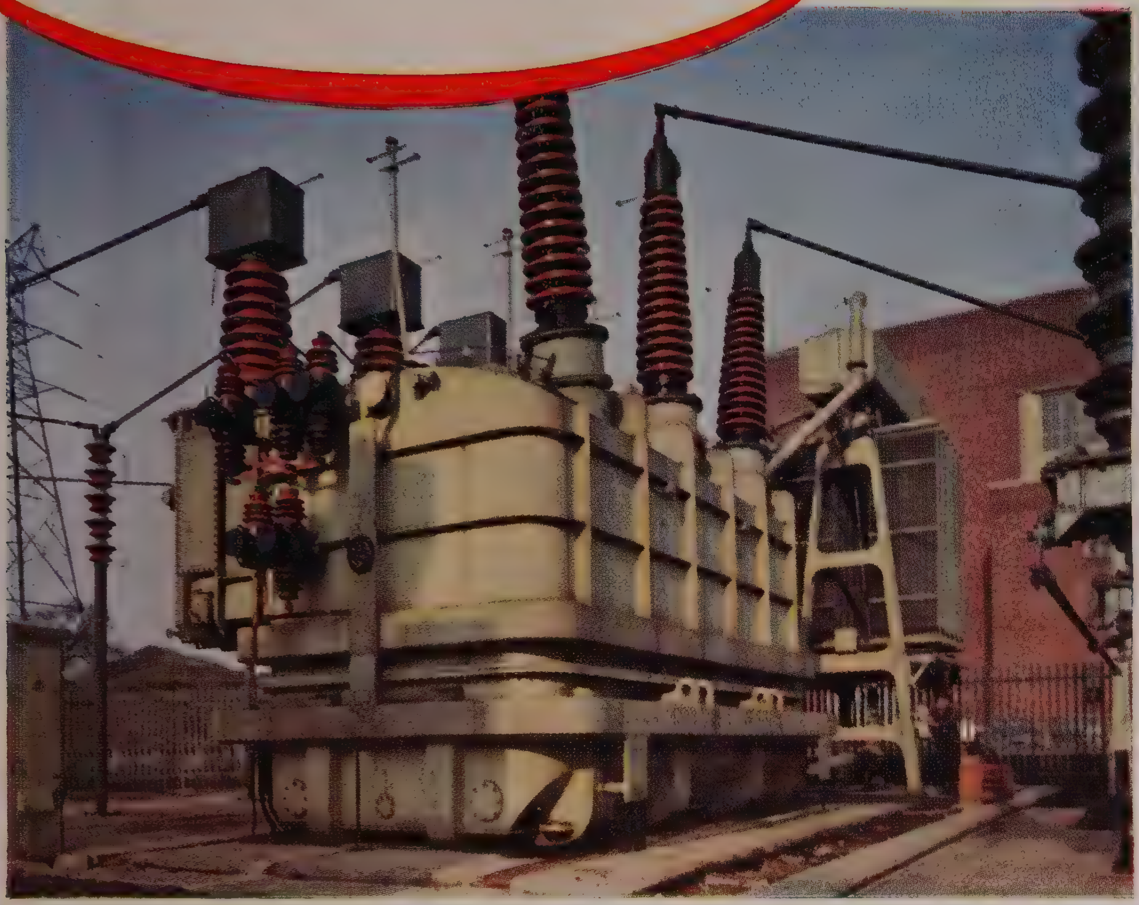

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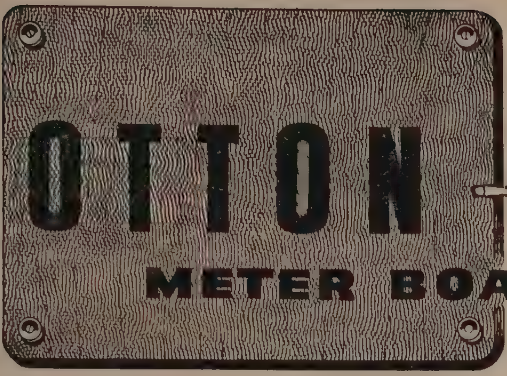

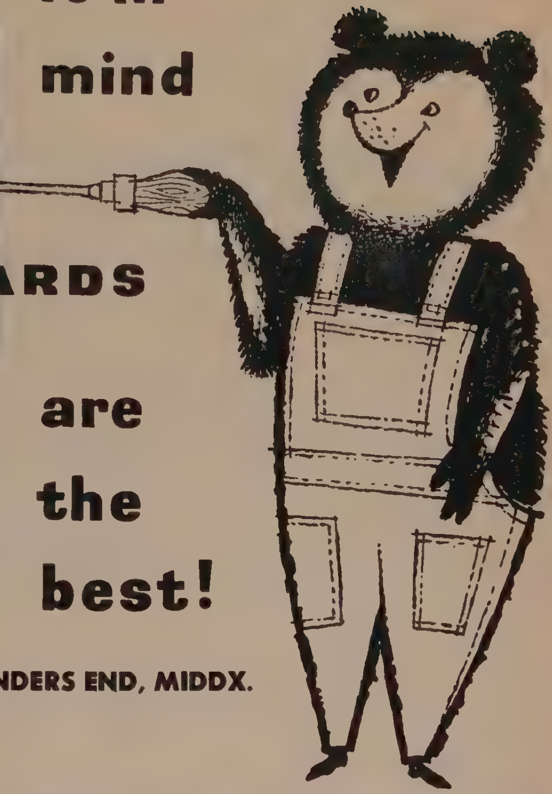

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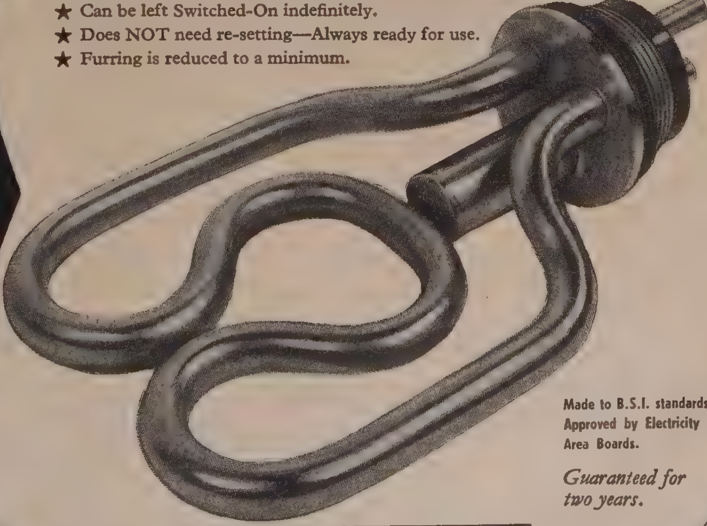

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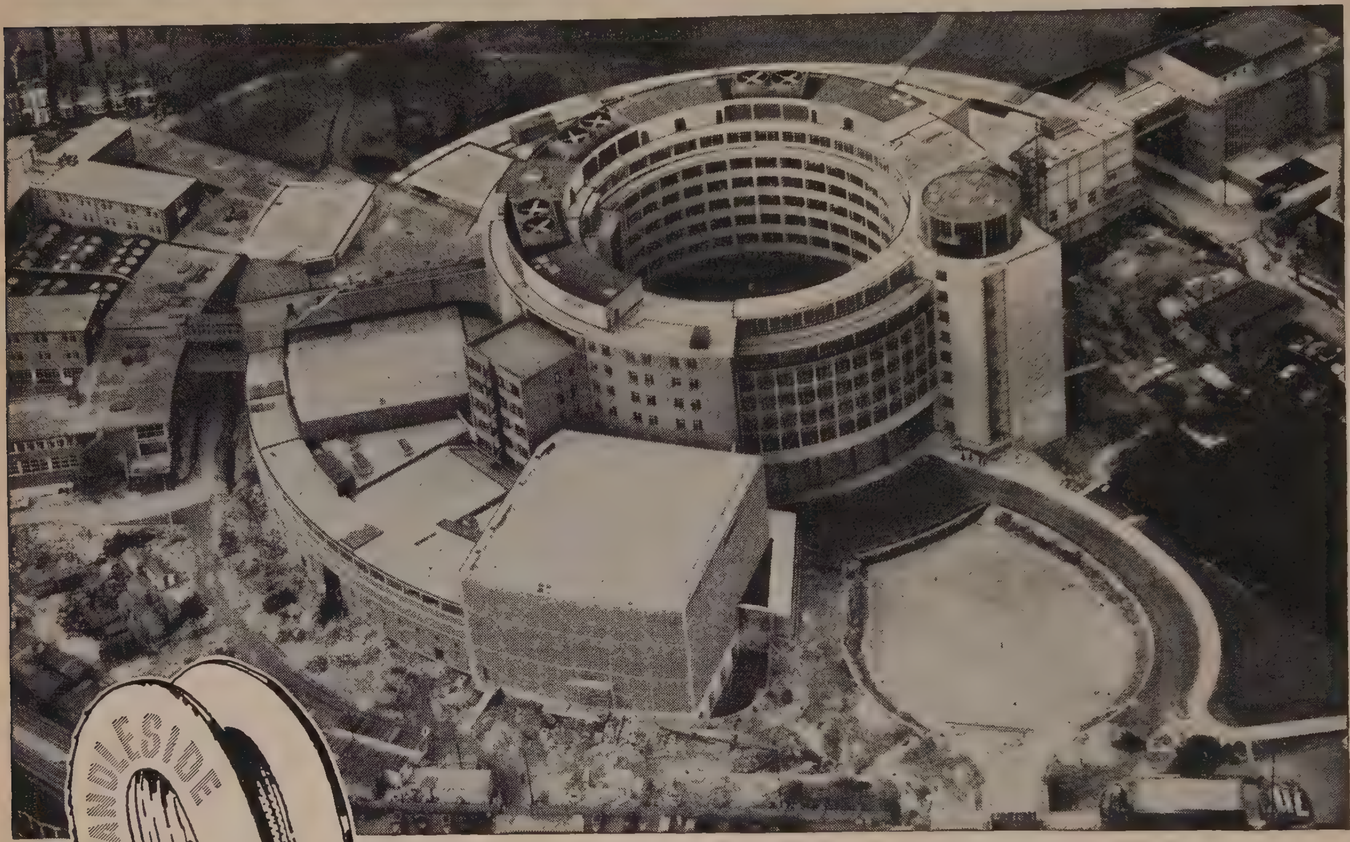

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(Photograph by courtesy of the B.B.C.)

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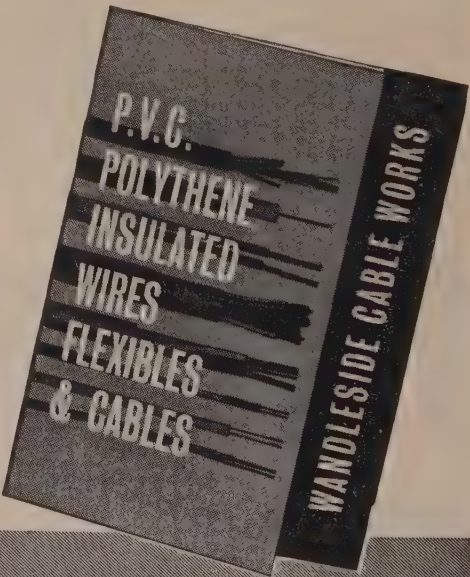

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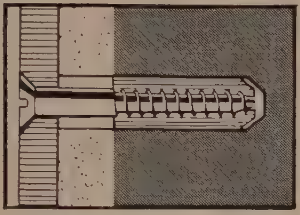
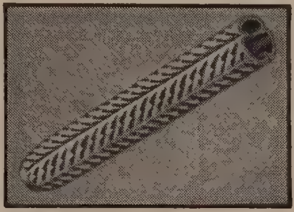
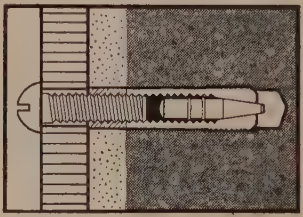


Use the famous RAWLPLUG for neat, firm fixings in brick, stone, etc. All sizes up to $\frac{3}{4}$" diameter Coach Screws. Rawlplugs are waterproof and unaffected by climatic conditions.

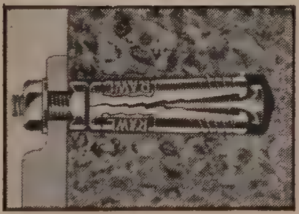


Rawlplug WHITE BRONZE PLUGS are specially suitable when the fixing is subject to very high temperatures, such as the outer brick coverings of furnaces. Use also for under-water fixtures.

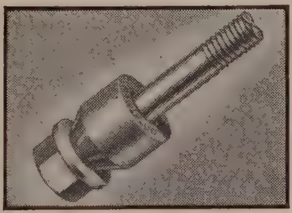


NEW! RAWLSETS, for $\frac{5}{32}$" and $\frac{3}{16}$" Whit. screws, are metal shell sockets which grip by expansion. Ideal for fixing signs, stoves, metal windows, fluorescent light fittings, etc. Write for leaflet.

Bolt Fixings



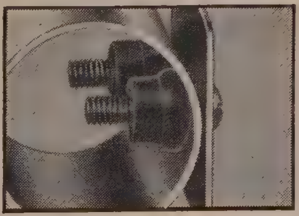
For bolting down machines, use RAWLBOLTS, a *dry* fixing that grips by expansion. No cold chiselling, no waiting for concrete to harden. Sizes up to 1" bolt diameter.



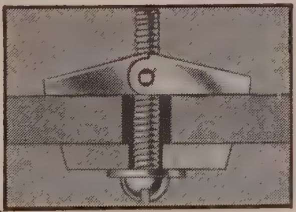
Use Rawlplug BOLT ANCHORS for bolting down in extremely wet or corrosive situations. Caulking completely seals the anchorage. Use also for anchoring Diesel Generators, Power Hammers, etc.

Rawlplug CEMENT-IN-SOCKETS are positioned before concrete is poured, eliminating hole-boring. They provide strong, permanent fixings wherever bolt locations can be pre-determined. For bolt diameters $\frac{1}{4}$" to 1".

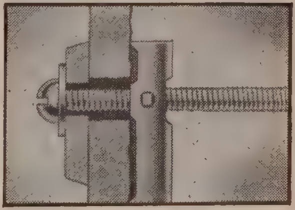
Cavity Fixings



Screwed up from the front the amazing RAWLNUT forms its own rivet head behind the material—airtight, watertight, vibration-proof, squeak-proof! For all thin or hollow materials.



For ceilings of lath and plaster, plasterboard, etc., use Rawlplug SPRING TOGGLES. The inserted Toggle springs open behind the material, spreading the load over a wide area.



Rawlplug GRAVITY TOGGLES are ideal for hollow materials from $\frac{1}{16}$" thick. Inserted horizontally, the long end falls into correct position by gravity. The screw is then tightened in normal way. For $\frac{1}{8}$", $\frac{3}{16}$" and $\frac{1}{4}$" Whit. Screws.

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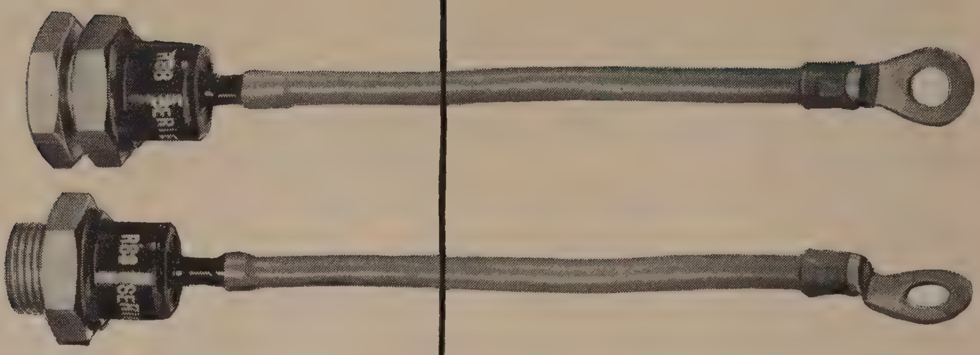

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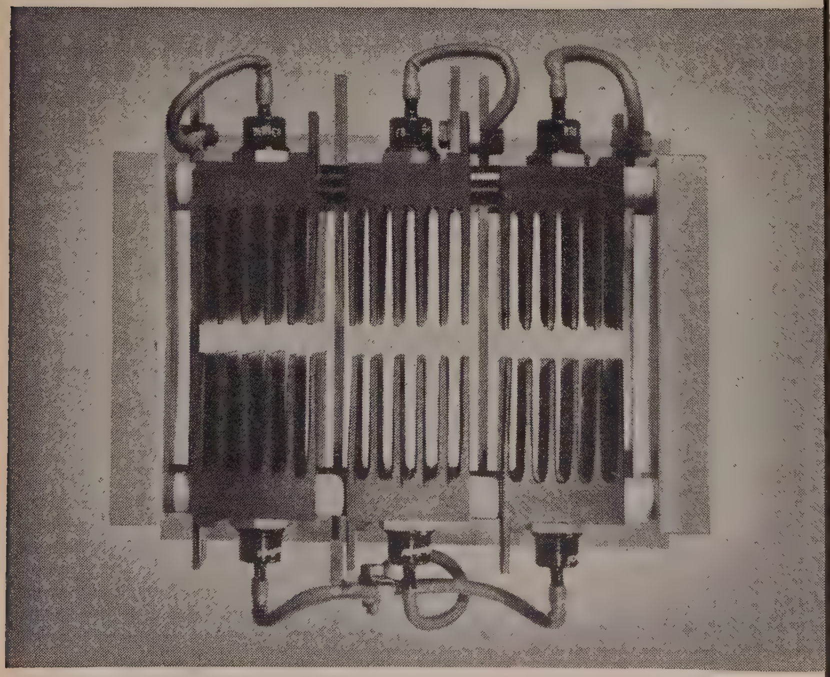
RS8 SILICON POWER DIODES

and RS8 SILICON RECTIFIER STACKS



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Maximum mean dissipation (with suitable heat sink)	150 watts

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EST. 1927

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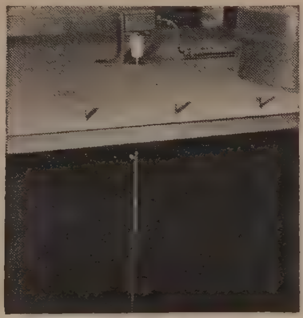

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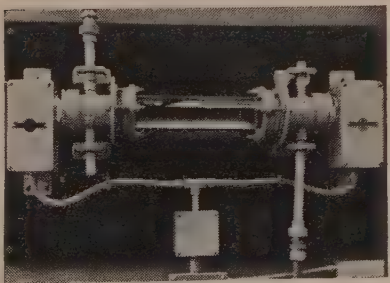
Radiovisor manufacture many different types of electronic level control so that from their range a unit will be found suitable for any material or liquid. Liquids in tanks, solids in hoppers or powders in packets—there is a level control for the job.



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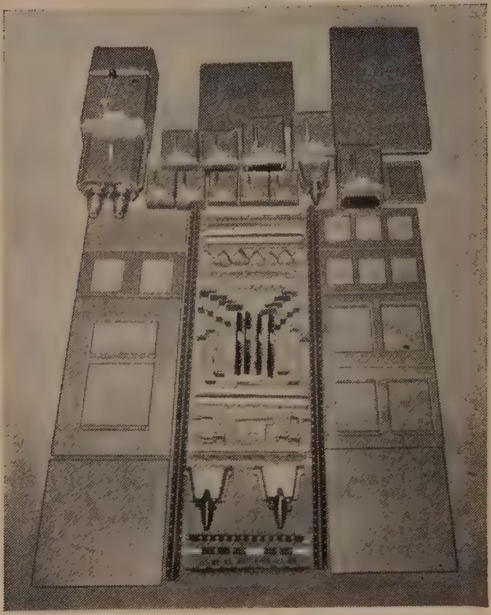

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Photographs by courtesy of The Midlands Electricity Board and The Governors of Sebright's Endowed Schools, Wolverly, Worcs.

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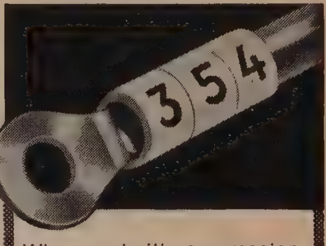

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★ Grips the cable firmly.

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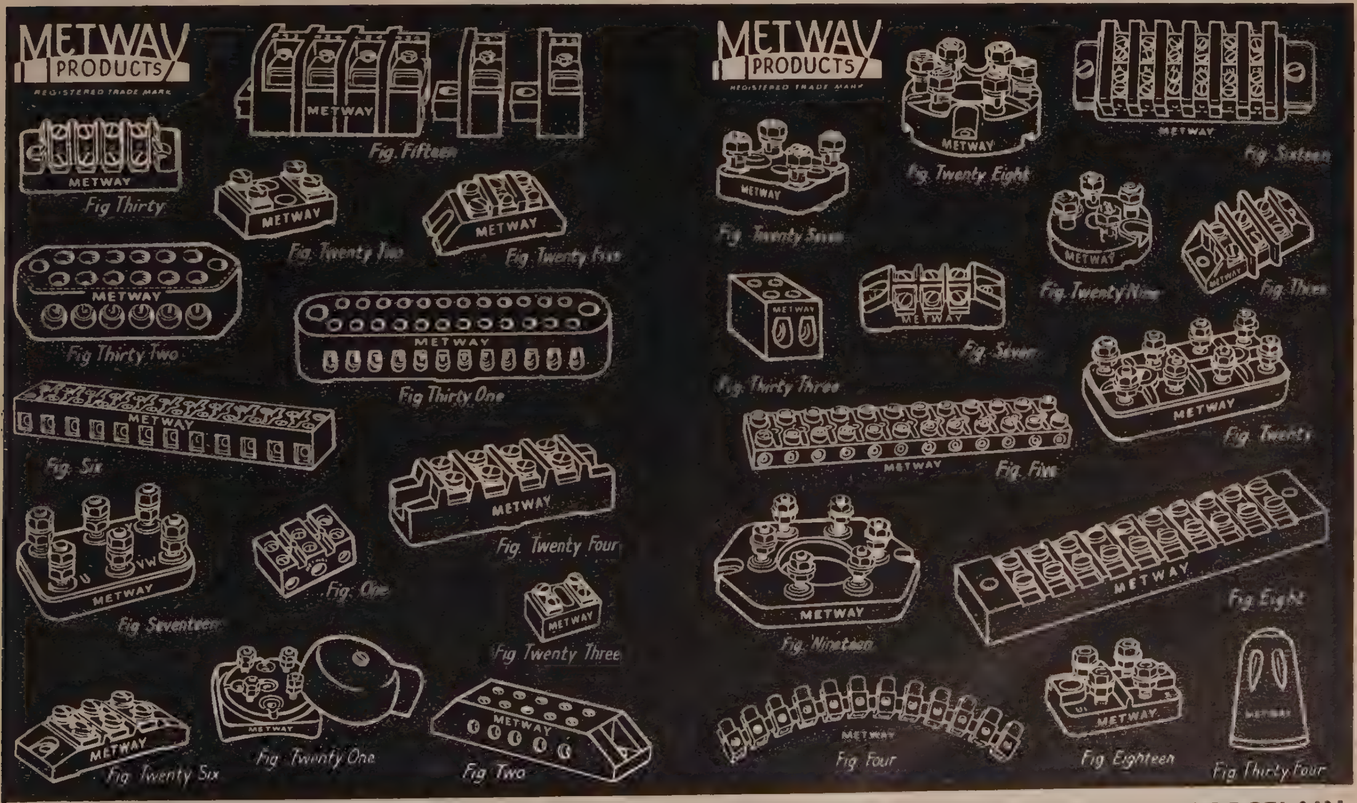

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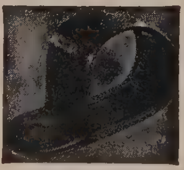

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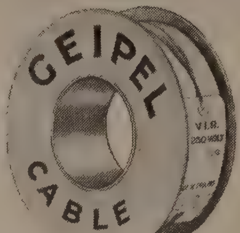

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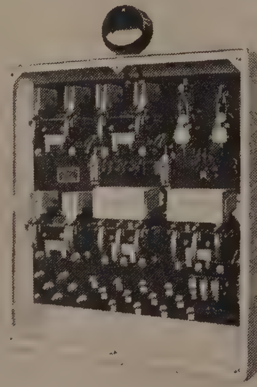

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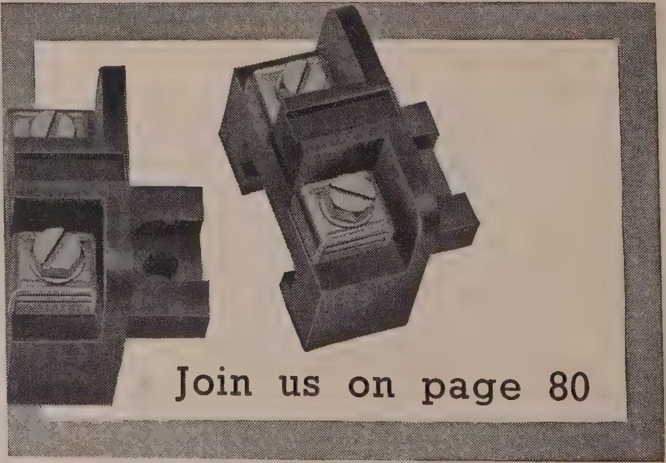

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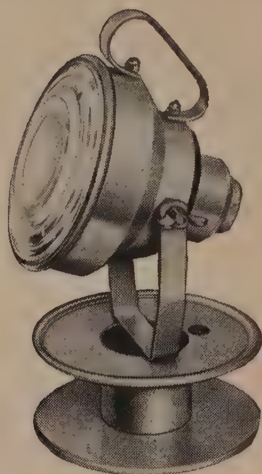
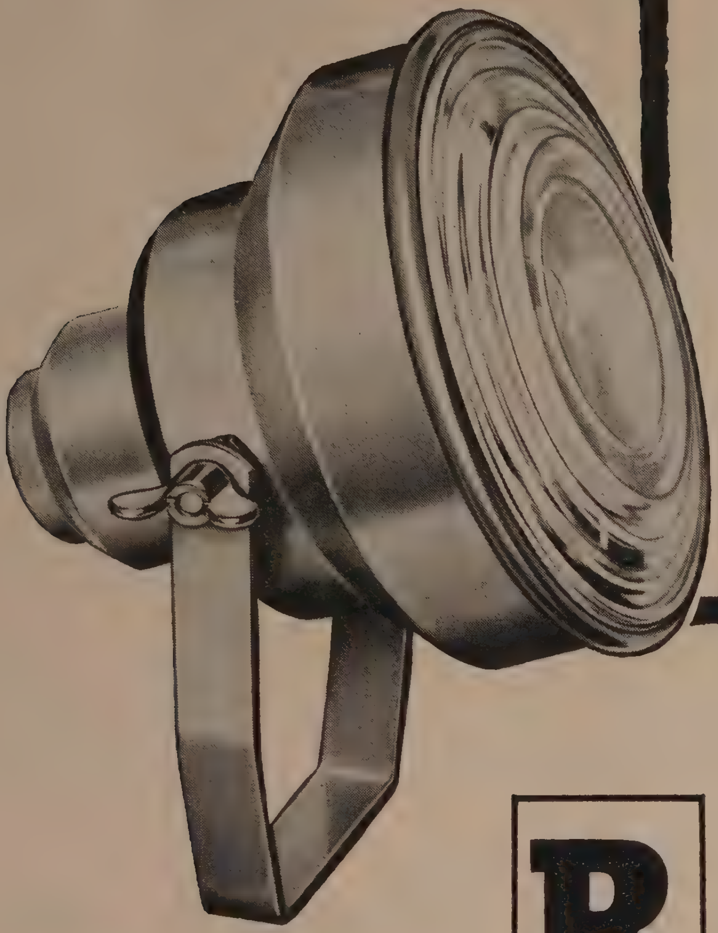


List No. 563
Transportable model with carrying handle and base in form of heavy steel drum for housing trailing cable.



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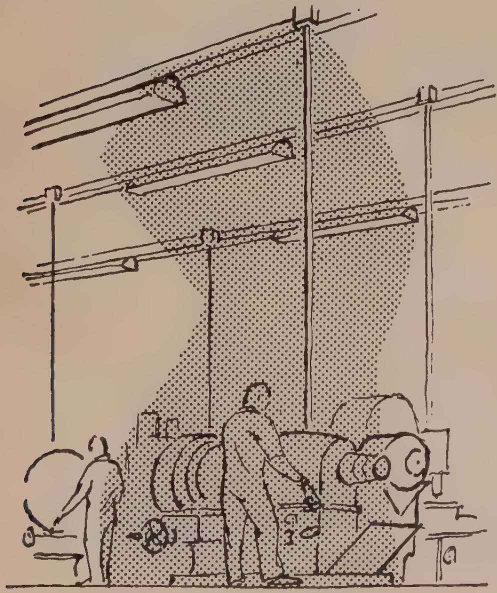

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★ 'Power-Line' is a simple and economic method of providing separate power and lighting circuits, or independent power circuits.

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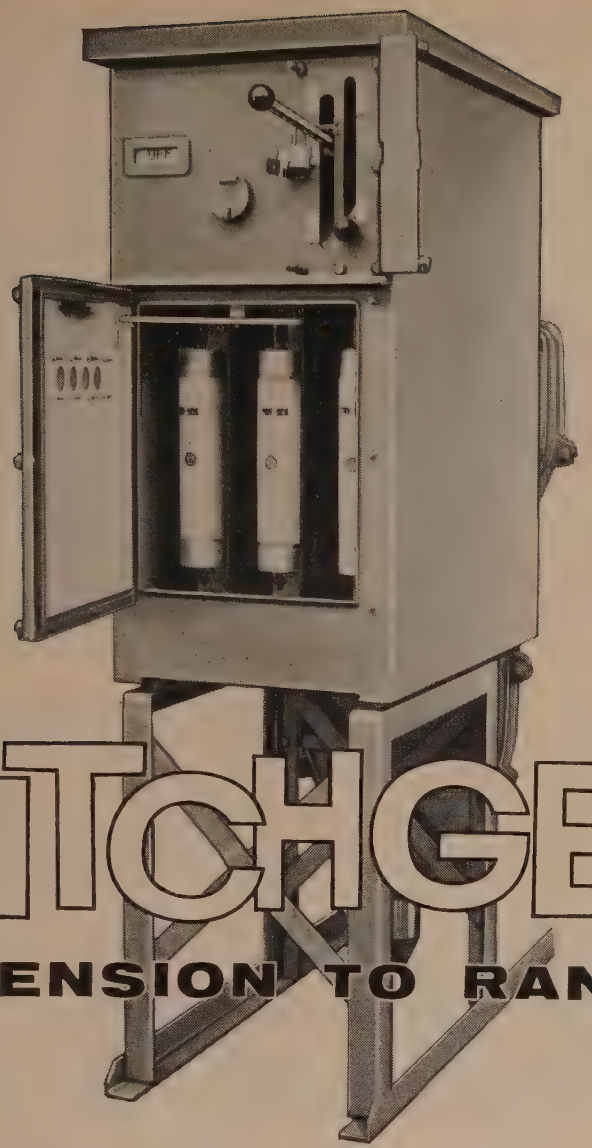

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Type HF 11 Switch-Fuse unit, with chamber door open, showing 90 ampere 11 kV fuse-links.

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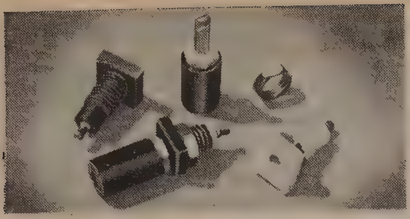

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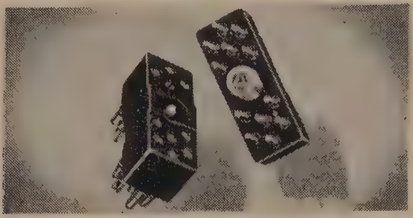

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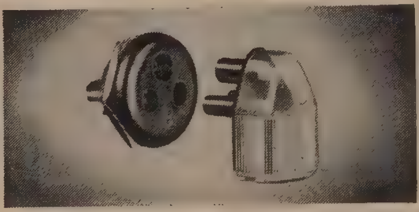
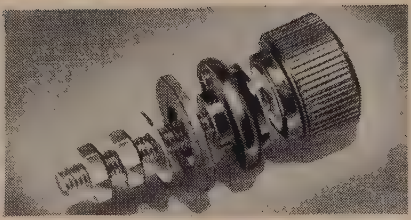
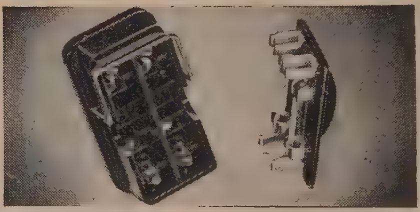
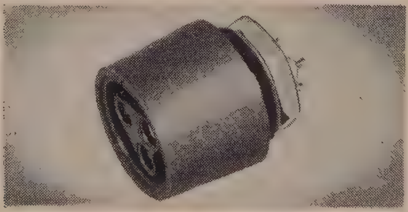


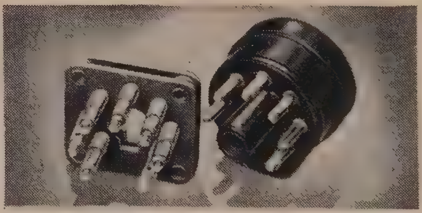


Electronic

Industry







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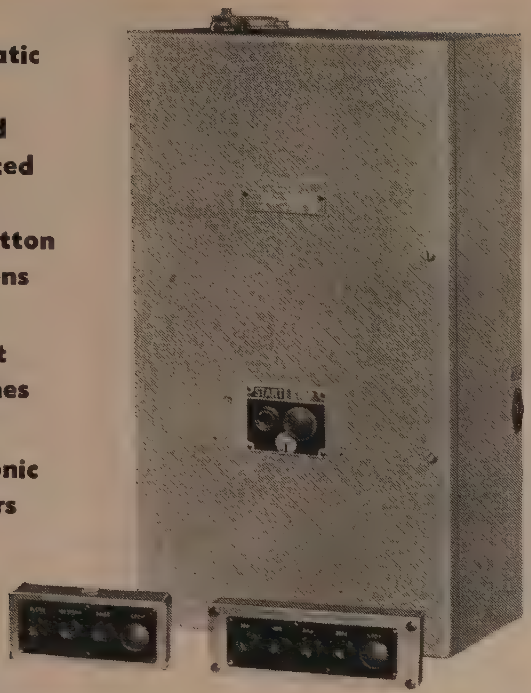

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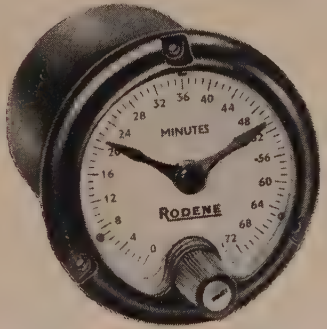

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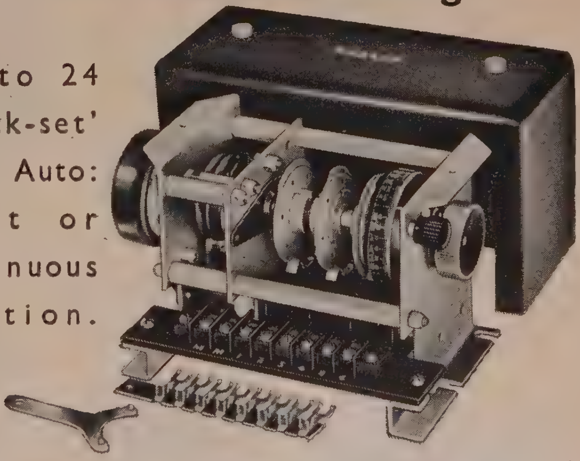

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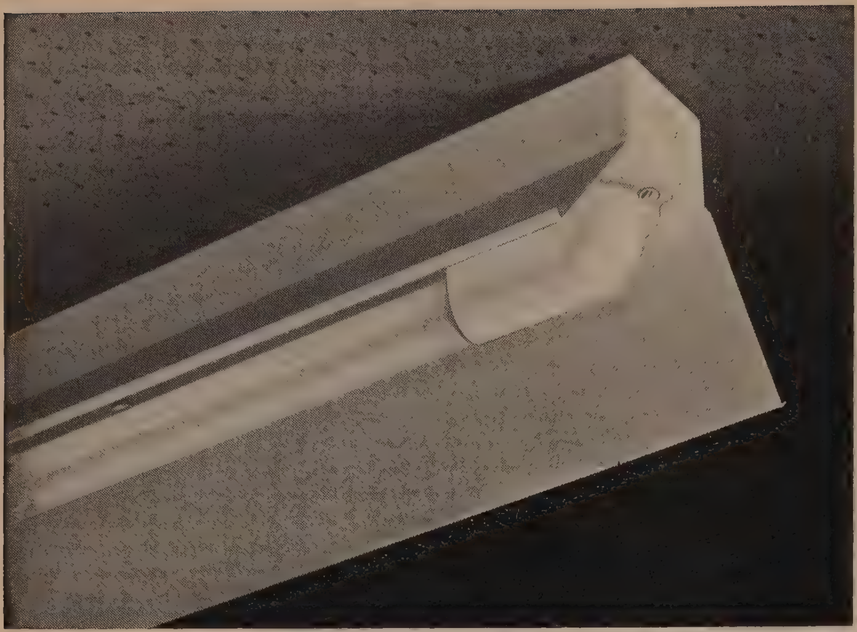

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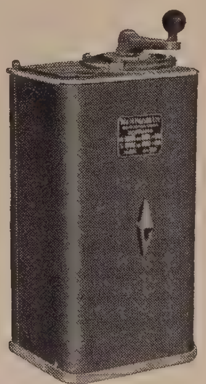

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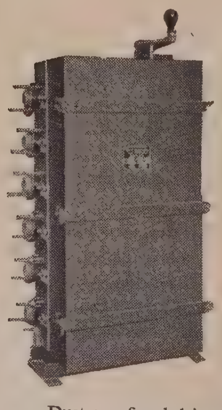

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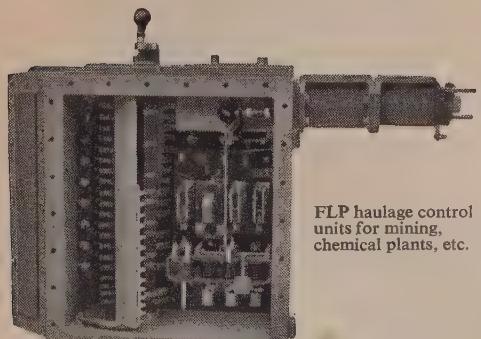

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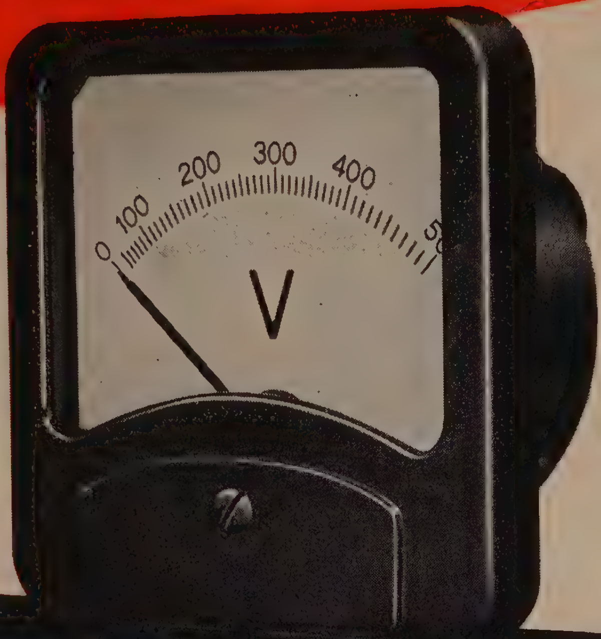

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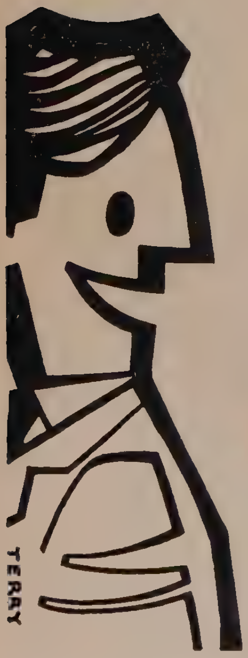

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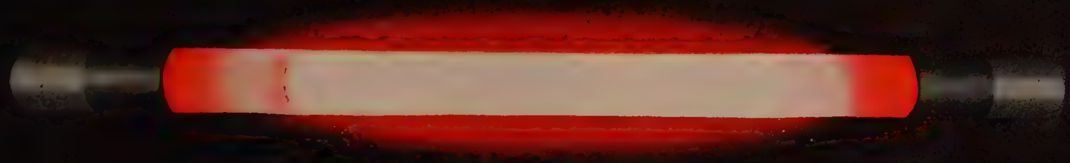

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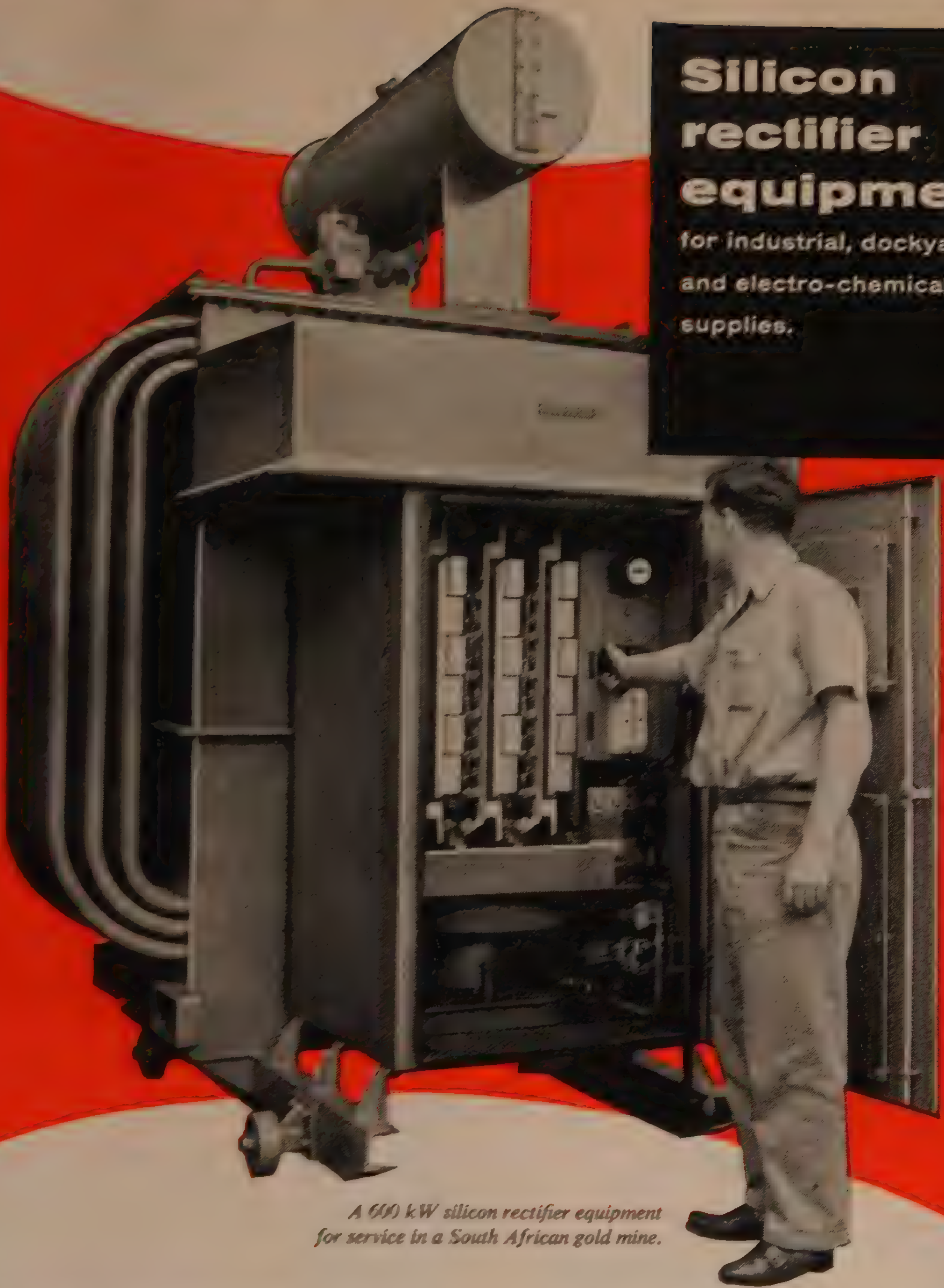

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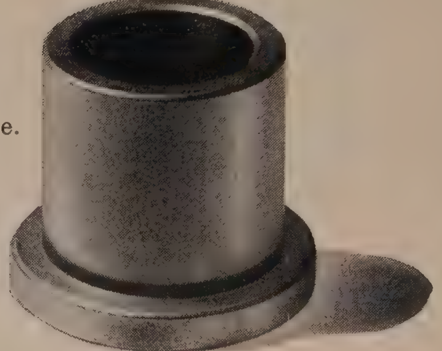

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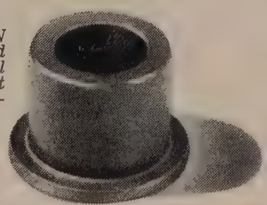

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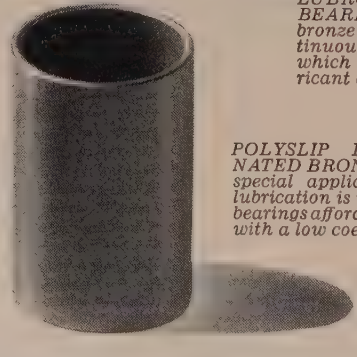

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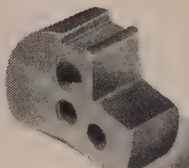

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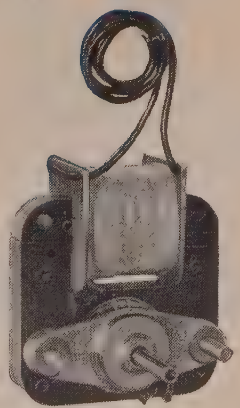

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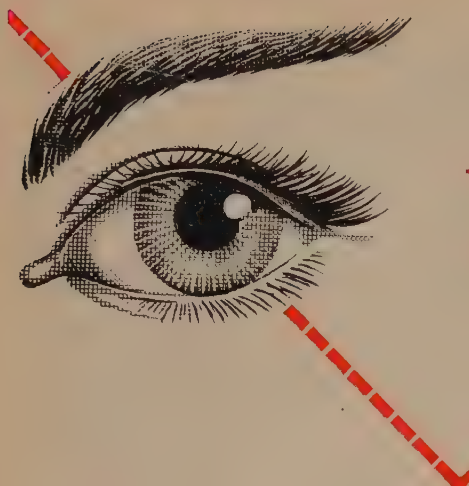

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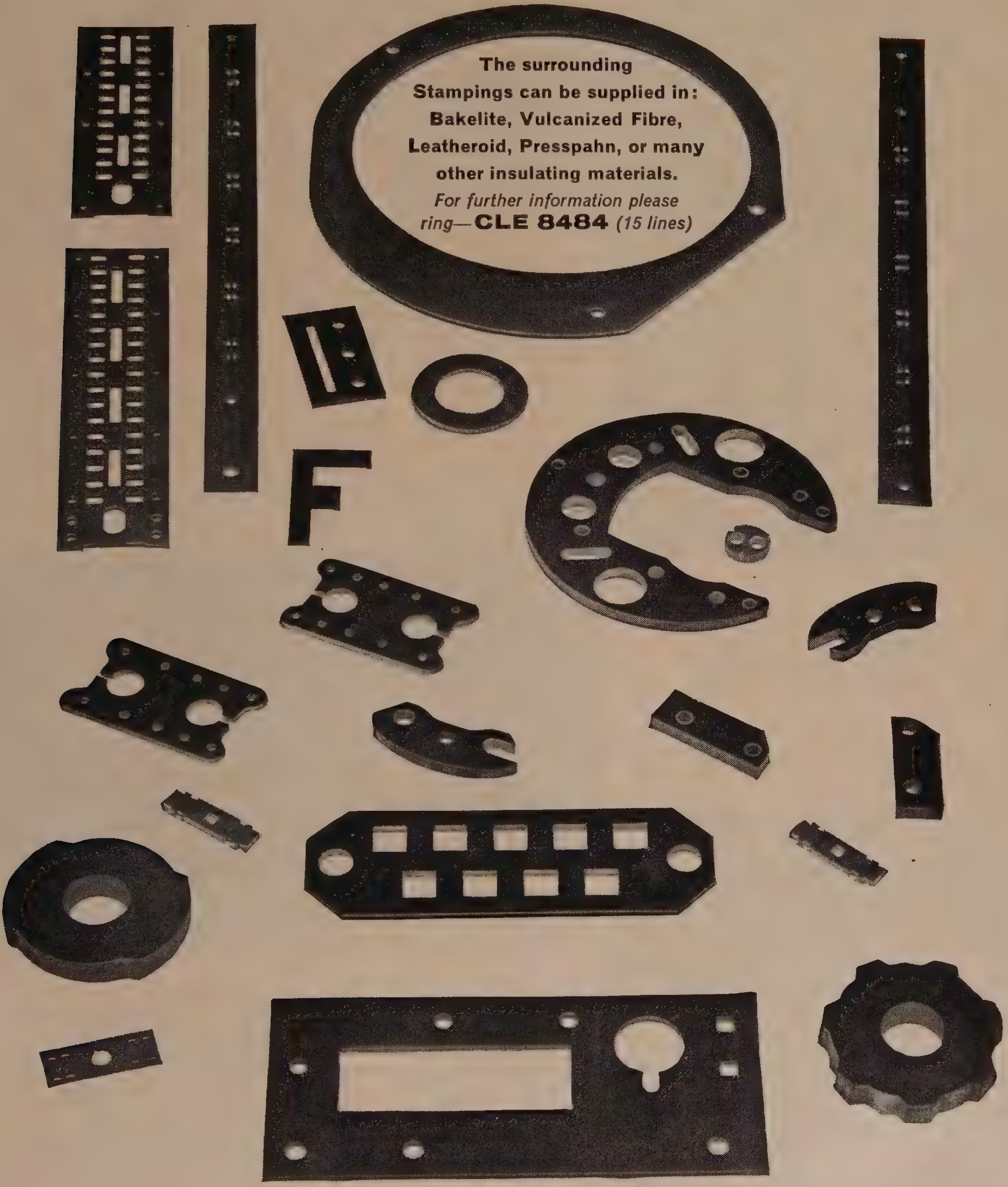

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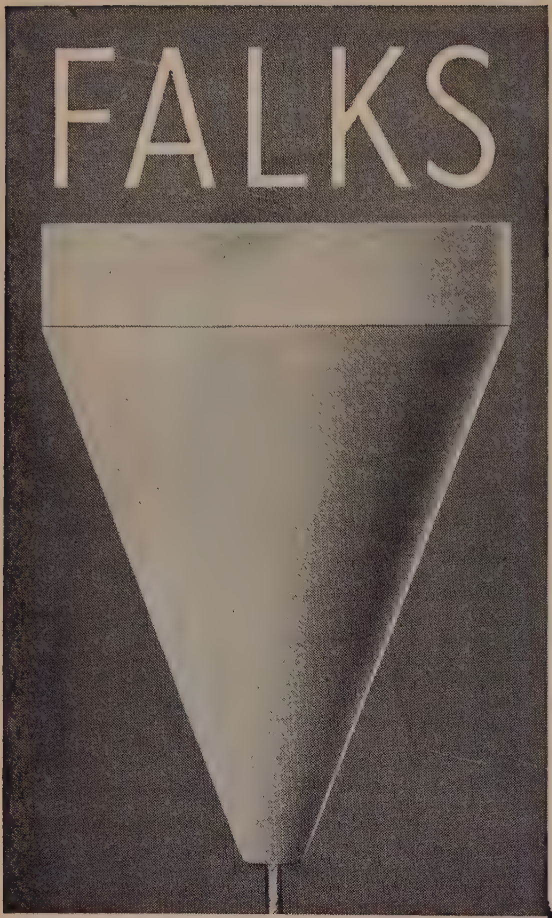
DELANCO WORKS, LEONARD STREET, LONDON, E.C.2



new "CORDCONE"

ceiling switch

The 13 amp. 250 volt ceiling switch with full inductive rating. Available in single pole 1 and 2 way, double pole 1 way, with or without pilot light, brown or ivory.

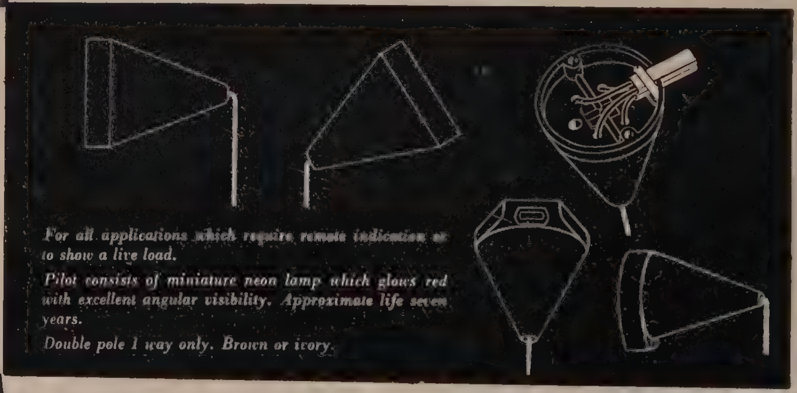
- ✳ *One rating only for domestic, commercial or industrial use, either lighting or power.*
- ✳ *Series break contacts particularly suitable for motor or fluorescent load. Will control up to thirty 80-watt fluorescent tubes and single phase motors up to ½ h.p. capacity.*
- ✳ *Single pole 1 or 2 way; double pole 1 way; 2 in. fixing centres.*
- ✳ *Double pole pattern available for bathroom fires.*
- ✳ *Easily replaceable cord.*
- ✳ *Completely insulated with no visible fixing screws.*
- ✳ *No dust traps.*
- ✳ *Ample cable stowage in base, terminals take 2×7/·029 cables.*
- ✳ *Conforms to B.S.2652 : 1955 for cord operated switches.*

Pattress available to assist compliance with 207G 13th Edition I.E.E. regulations. Pattress also supplied with integral looping in terminal.

Operates successfully with cord at any angle up to 90° from vertical.

✳ *Special cable clamp available for use with surface wiring. Surface knockouts are provided.*

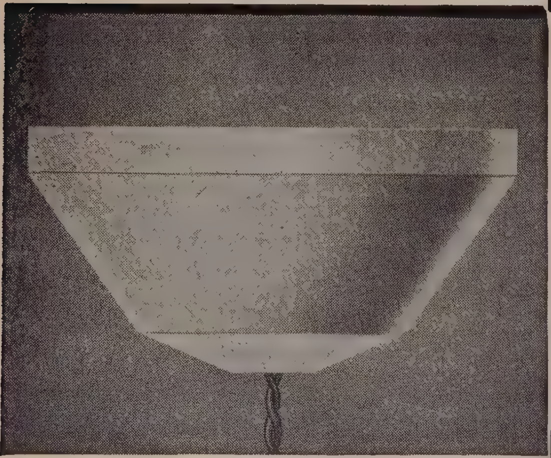
"CORDCONE" *with pilot light* ▶



For all applications which require remote indication or to show a live load.

Pilot consists of miniature neon lamp which glows red with excellent angular visibility. Approximate life seven years.

Double pole 1 way only. Brown or ivory.



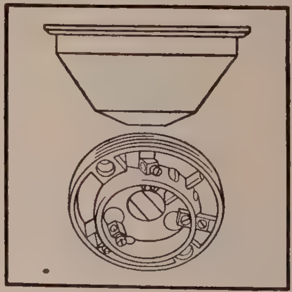
and FALKS "FLEXCONE"

a matching ceiling rose

Styled to match the "Cordcone" ceiling switch, to meet the requirements of modern installations. May be used without block or pattress.

Available 2 or 3 plate, brown or ivory, with or without flange.

✳ *2 in. centre fixing with or without flange.* ✳ *A flange pattern for conduit box fixing or for covering rough ceiling holes.* ✳ *Angled terminals for easy wiring.* ✳ *Very effective cord grip.* ✳ *With closed back, hence needing no pattress.* ✳ *No visible fixing screws.* ✳ *Conforms to B.S.67:1938.* ✳ *Overall cover.*



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(CC3)

A new Grommet development

THE DOUBLE SEALING EMPIRE RUBBER GROMMET

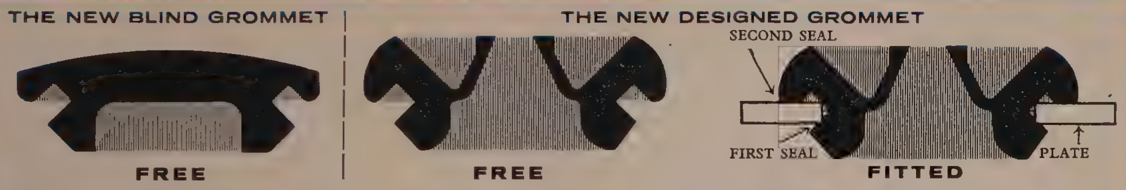
infinitely accommodating in use: considerably reduces range of sizes because the same grommet can be used with several plate thicknesses or cable sizes

PAT. APP. No. 5255/59

This newly developed self-conforming grommet, because it is immediately self-locking against the elements, is the solution to many of an engineer's sealing problems.

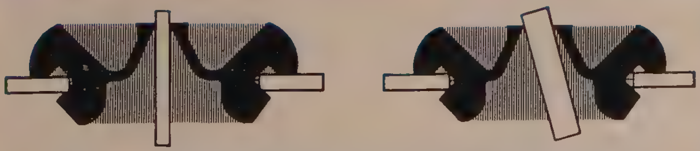
Any one size will not only accommodate itself to a variety of mounting plate thicknesses, but (designed for cable or control rod) will take these in a variety of sizes and be weather-, water- and dust-proof at a variety of angles to the cable or rod.

Because of its capacity to conform to many varying requirements, it enables a workshop stock range of grommets to be reduced to perhaps one tenth of that at present maintained.

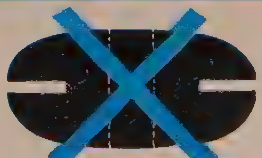


Note how when sprung into position the grommet provides a perfect double seal by its own permanent pressures. The angled groove also creates a tight pressure hold on the metal plate.

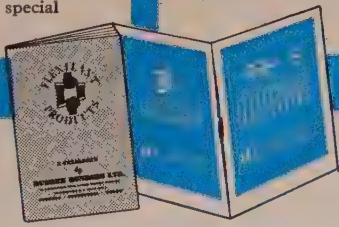
In the cable grommet variety the same double pressure seal is created, allied to tight seal on various diameters of cable. This new grommet gives sound sealing at *all* vital points.



A useful feature of this cable grommet is that by reason of the designed taper of the cable entry and the flexibility of the web, a considerable angle of cable entry and a variety of cable size are possible. This avoids necessity for special grommets with angled bores.



In the conventional grommet, only one thickness of plate and only one size of cable can be accommodated. No effective seal is afforded by the parallel groove.



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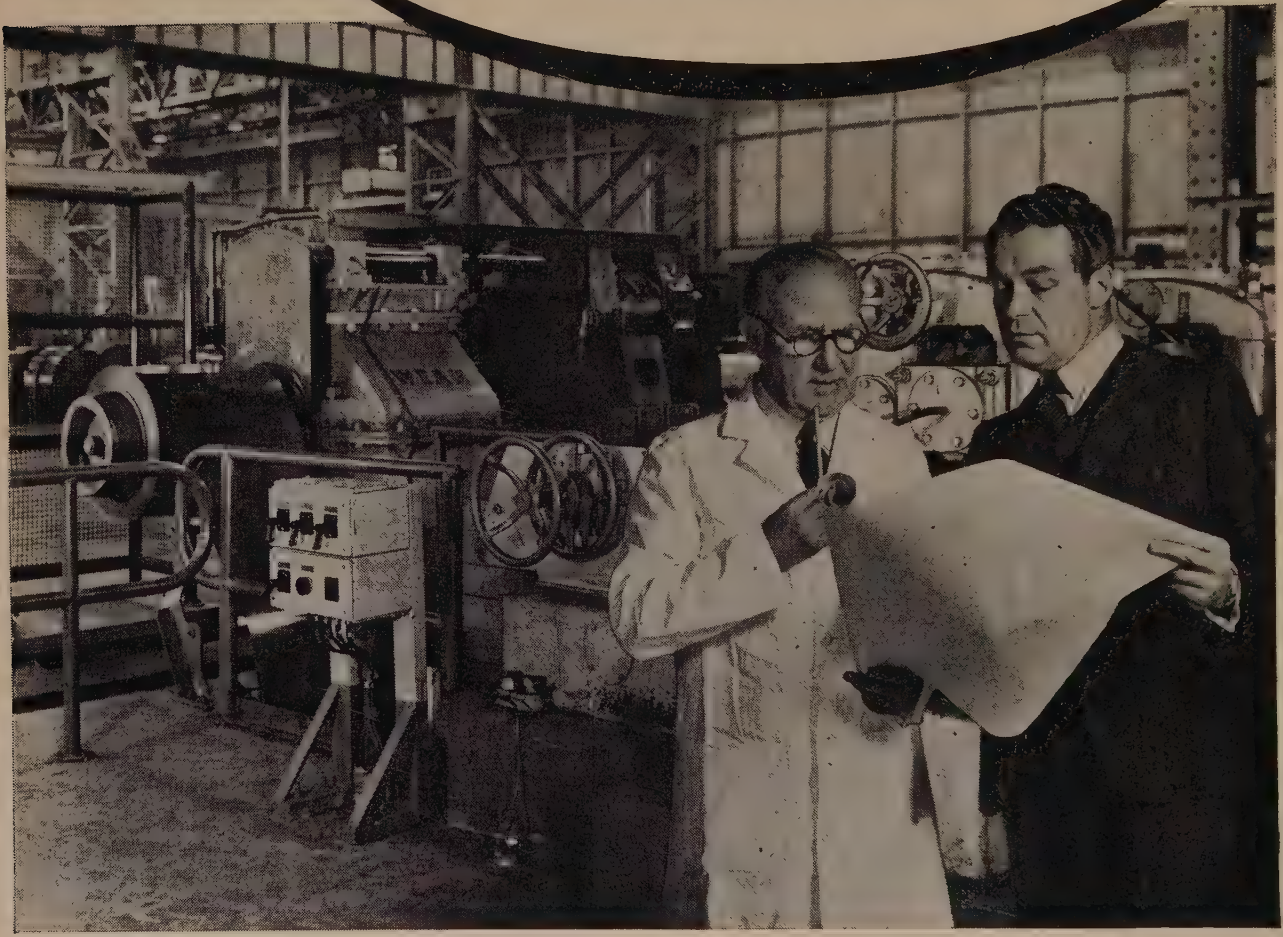

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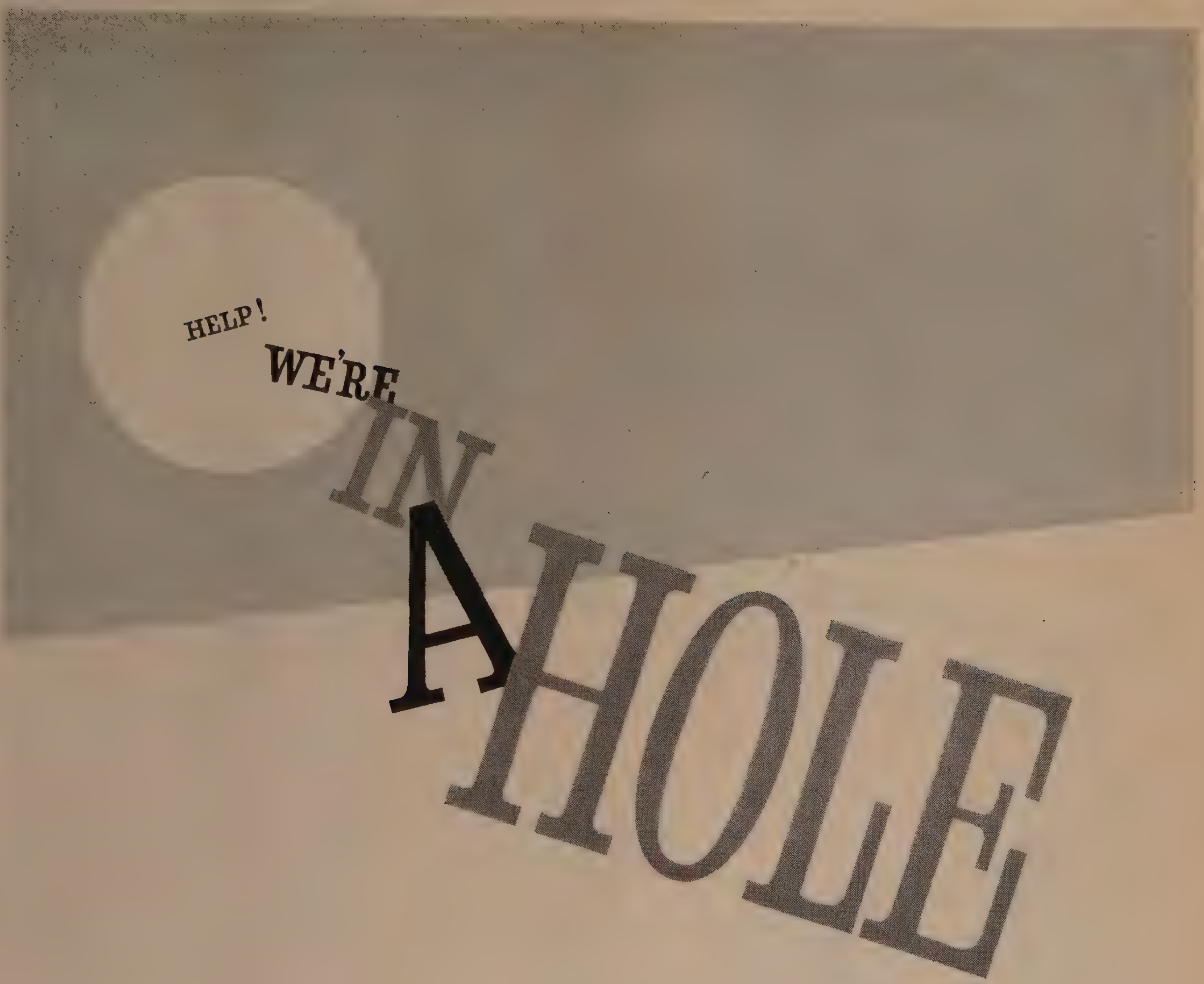

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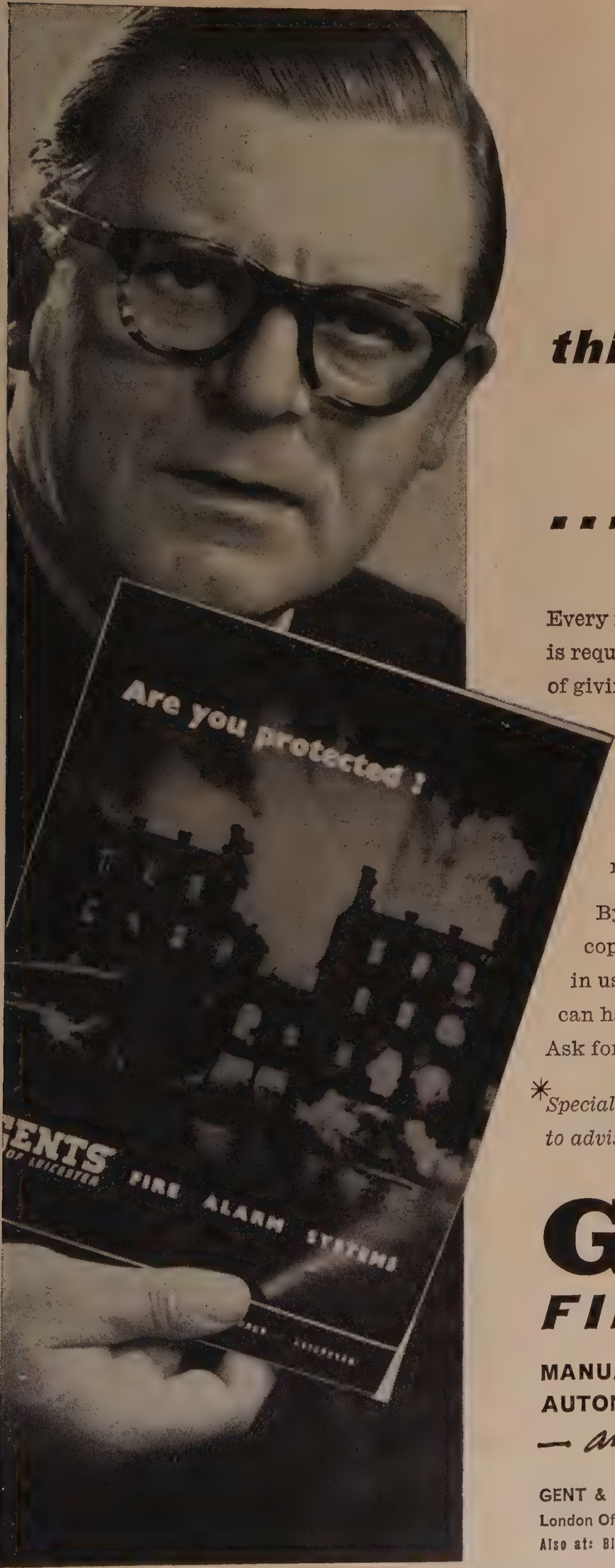

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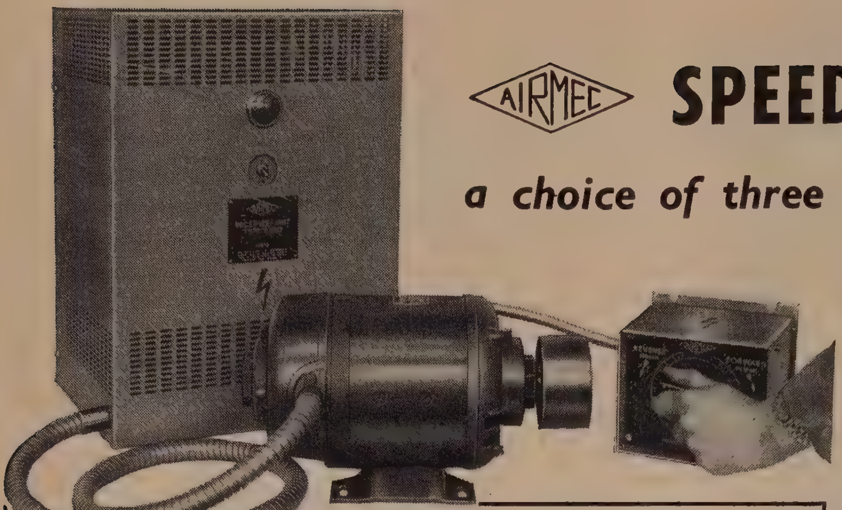

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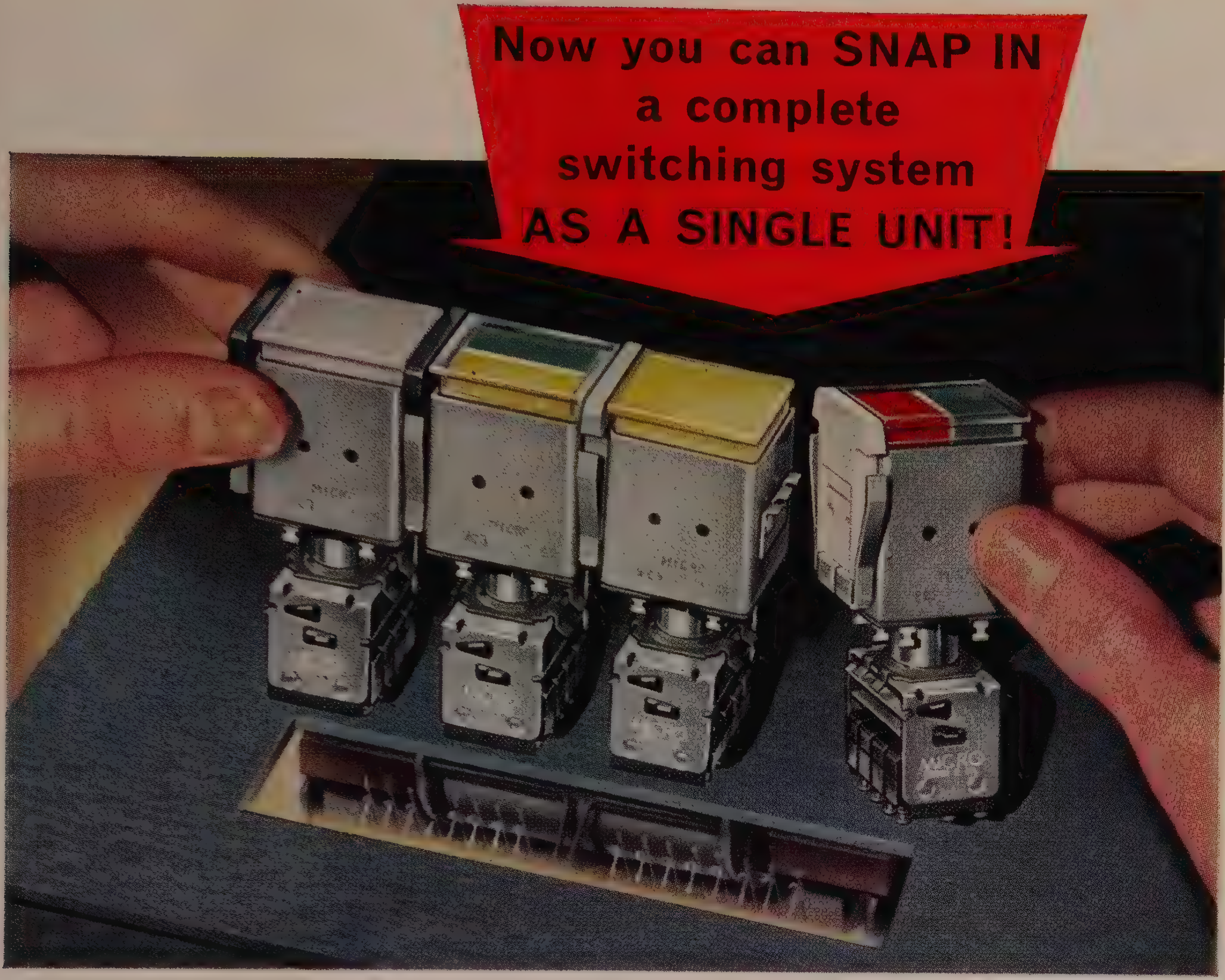

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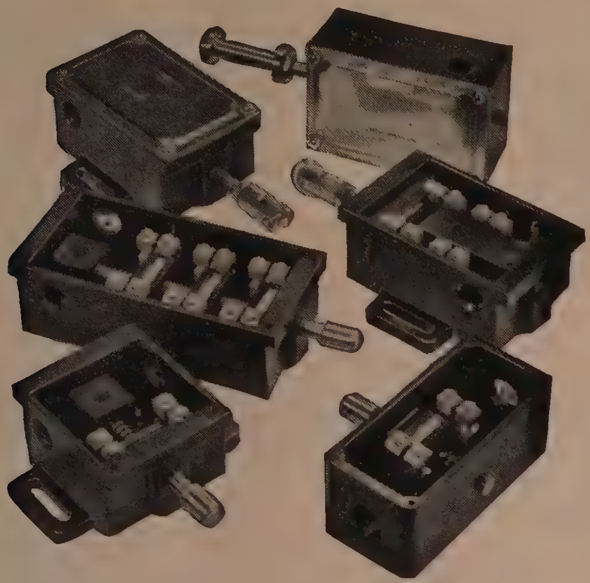

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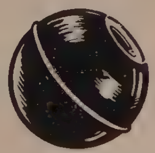

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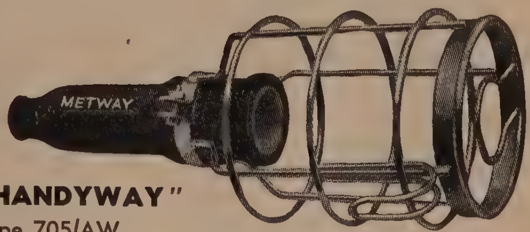

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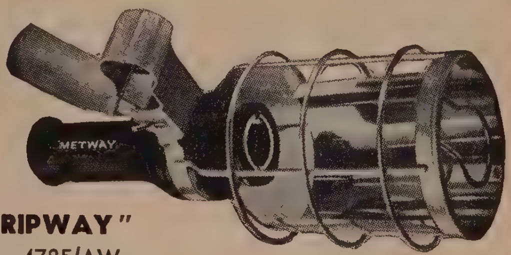
Type 2705/AWS with switch. **11/11** each



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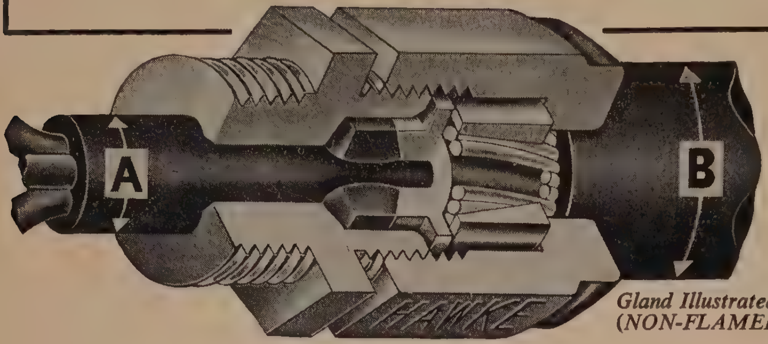

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These glands give controlled compression. Their patented features make it impossible to damage the inner sheath and cores when using Lead or P.V.C. Sheathed Cables. They will accommodate varying gauges of armour, are Flameproof/Watertight, are approved by Canadian Standards, and are obtainable in any metal to suit the particular situation. They are 1 in. shorter than the 'Hawke' Glands now being manufactured.

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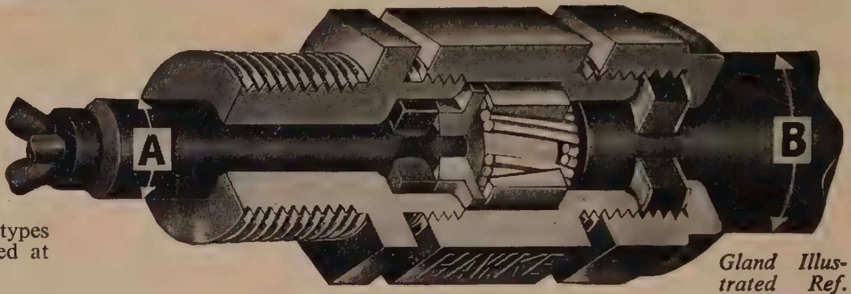

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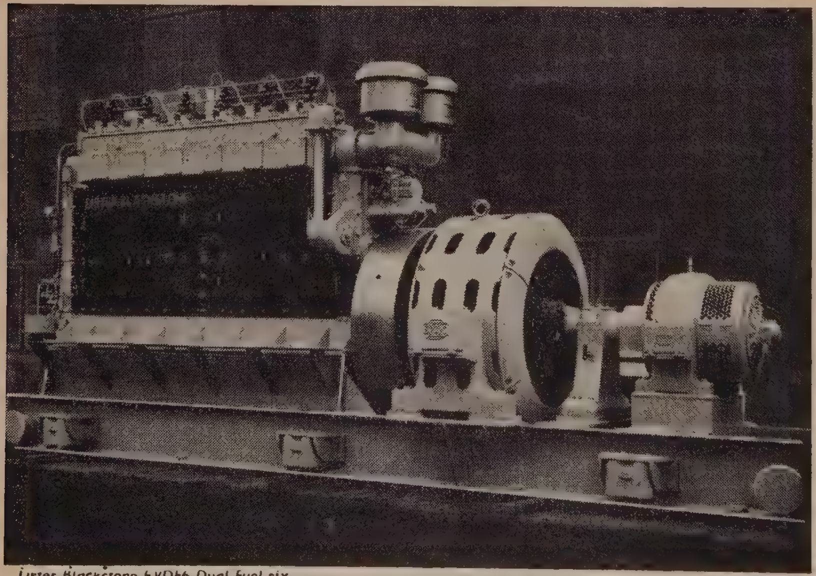

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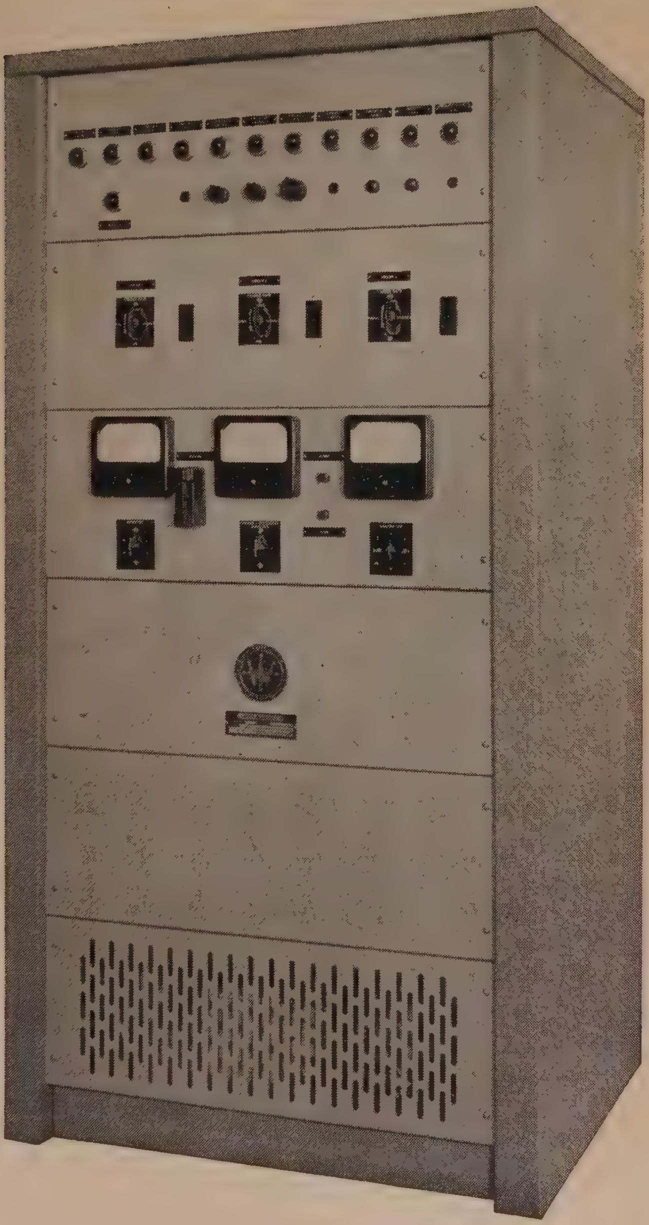

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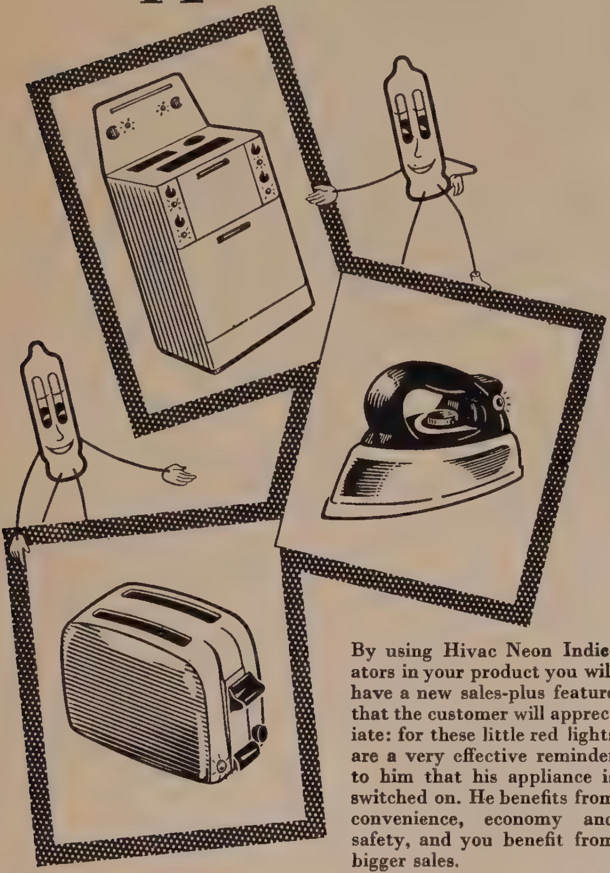

By using Hivac Neon Indicators in your product you will have a new sales-plus feature that the customer will appreciate: for these little red lights are a very effective reminder to him that his appliance is switched on. He benefits from convenience, economy and safety, and you benefit from bigger sales.

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fit a
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It just glows to show!

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From 1 to 500 K.V.A.

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Arranged for the following types of starting:
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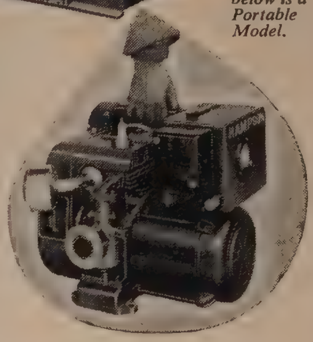
★ **Live Agents required throughout the world for Sales and Distribution.**

Manufacturers of the largest range of Generating Sets in the World, from a Portable model to complete power for an entire town.

Illustrated below is a Portable Model.



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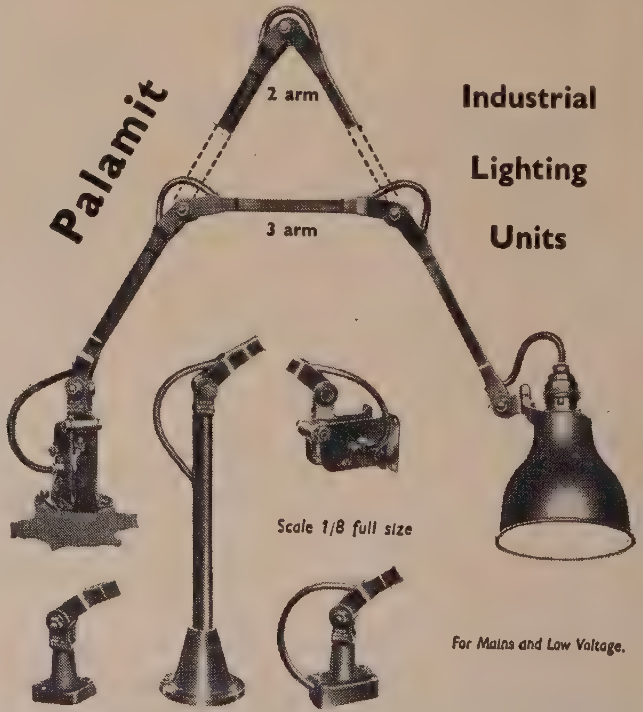

Palamit units are for use where the advantages of **MEKELITE** units have to be sacrificed to the consideration of low first cost. The difference in price is due to the simplified design and not to lower standards of material and workmanship.

Various arm lengths (max. horizontal reach 39 in.). Five sizes of reflector. Seven types of base. *Full particulars on request.*

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LTV

long
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vertical

reels

★ now make high winding speeds possible with the finer gauge wires

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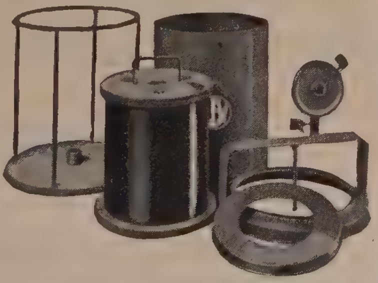
★ increase production time due to less ‘change-over’ periods

The speed, ease of operation and compactness of the LTV reel saves costs. LTV reels also contribute to economy through time saved on fewer ‘change-over’ periods and a reduction in the number of short ends of wire.

WINDING-OFF UNIT

The various items of equipment comprising the winding-off devices can be supplied. With the exception of the flange rings they are common to both sizes of reel.
The unit has been specially designed for trouble-free operation, but, should a breakage occur, the running end of the wire can be located in a matter of seconds.



The LEWCOS LTV reel is the result of much research in developing successful high-speed winding techniques for fine gauge insulated wires.

Mainly designed for the range of wires ·0124″ and finer (at the moment down to ·0068″) LTV reels eliminate most problems associated with winding fine wire coils. LTV reels are supplied in two sizes, LTV 30 and LTV 60 containing a nominal net weight of 30 lbs. and 60 lbs. respectively. They can be supplied on pallets for efficient transport and storage.

For full details of LTV reels please contact our Leyton Works (LEYtonstone 3636) or the nearest Branch Office.

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED

LEYTON · LONDON · E10

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Belling, Hotpoint, Morphy-Richards
and Thermovent convector heaters
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FRIDAY
25 NOVEMBER
1960

ELECTRICAL REVIEW

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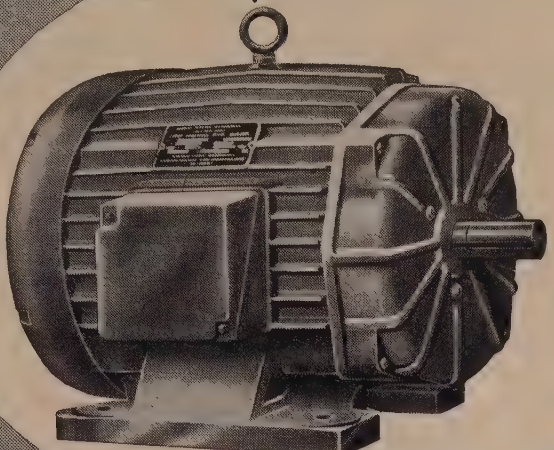

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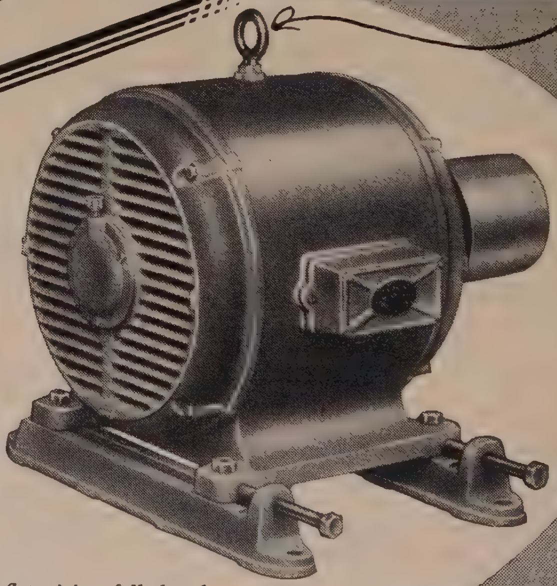

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ELECTRICAL REVIEW

25 November 1960 Vol. 167 No. 22 Established 1872

Investment Control

THE Electricity Boards not only have to provide the plant necessary to meet the growing load; they are also required to develop that load and so increase its growth. In pursuing the second of these duties the industry is making matters harder for itself in carrying out the first duty: if it were less active in load promotion it would have an easier time in plant provision. That the industry has been notably successful in both these tasks is evident from two facts: it has secured an annual load increase equivalent to a doubling in ten years and for four of these decades in succession; and it has coped with this load growth without serious breakdowns except for the *force majeure* of wartime shortages.

The penalty of rapid growth in an industry employing expensive and rapidly changing equipment is a continual need for fresh capital. Since this is now Government-provided, the necessity presents a periodical opportunity for the industry's programmes and investments to be debated in Parliament. In the two-day debate reported in our last issue the electricity programme, although the largest amongst the nationalised industries, came in for little adverse criticism. Possibly its very size, and certainly its complexity, deterred all but the bravest or the most technically equipped of Members from querying either the rate or the direction of its investments.

In an article in this issue Mr. D. J. Bolton describes the mechanism of Government control of electricity supply finances, not without some reservation as to how far the industry is in fact controllable. He concludes that in respect of the rate of flow of capital investment the Government can modulate it but not moderate it.

It cannot be said that the recent Parliamentary proceedings threw much light on the solution of the intractable problem of how to reconcile political control with the Boards' freedom of initiative. The debate did, however, bring out one thing. A nationalised industry, and particularly a highly complex and technical one like electricity supply, has a clear duty to perform for the benefit of its lay audience, critics and friends alike. It must do all it can to supply the information and explanations which alone can make Governmental control and Parliamentary intervention informed and effective.

SELLING RAILWAY ELECTRIFICATION

The electrification of a further 111 track miles of suburban lines to the north east of London in under three years shows how quickly an effective scheme of railway electrification can be completed when there is continuity in planning and execution. More important than the distance covered by the new services is the fact that nearly a million people are now served by a modern railway system. The whole scheme, with its improved track, new trains and signalling, and many modern station buildings, is a fine achievement that has received far less attention than it deserves. The operating staff are, however, confident that the public will respond to electrification as they have done in the past and the estimate of "a doubling of receipts in a few years" may well prove to be actually pessimistic.

The outlook for railway electrification in this country might be brighter if the railways and the manufacturers were more active in enlisting the support of public opinion. There is no doubt of the railways' firm belief in electrification as the only satisfactory treatment of the heavily loaded main and suburban lines that are the "mass carriers" of passengers and freight. There has been close and fruitful co-operation with the manufacturers, who have invested heavily to be in a position to supply the equipment required, and both the railways and manufacturers are keenly aware of the extent to which ability to compete overseas is governed by practice at home.

RAPID ACCELERATION NEEDED

The recent debate in the House of Commons revealed a sad lack of appreciation of these different, but closely inter-related, aspects of railway electrification. The modernisation of essential lines is generally accepted as part of the urgent need to improve this country's transport system. It is well to remember, therefore, that more than half the cost of complete electrification will be required in any case to bring the track, station facilities and signalling up to modern standards. The adoption of diesel traction may be slightly cheaper than electrification, but the higher receipts from the latter will outweigh the difference in a few years. "Dieselisation" in those circumstances is a policy of expediency (and therefore beloved of politicians). It may bring some immediate benefits to both passengers and operators but experience has shown that only complete electrification stimulates the growth of traffic to an extent that fully justifies heavy expenditure on modernisation.

The early concentration on suburban schemes has tended to direct attention to the complications of the high-voltage system. But in the Eastern Region, at least, the next stage will be to extend outwards along the main lines, and here the relative cheapness of the system will be shown to advantage. Manufacturers and contractors have now got into their stride in the building and installation of the new equipment and the full benefit of this experience will be lost if electrification is stopped or slowed down. On all accounts, including that of national investment policy, the time is ripe for a rapid acceleration of railway electrification.

ELECTRICITY IN AIRCRAFT

A graph published in last week's issue showed the general trend in aircraft electrical power requirements, and in so doing illustrated vividly the increasing use being made of electrical equipment in aeroplanes. The present airliner is shown to have nearly 160 kW of installed capacity and a very steep rise is forecast towards 450 kW by the mid-sixties for the next "generation" of aircraft. The graph illustrated a report of a lecture given by Lord Caldecote at a joint meeting of the Institution of Electrical Engineers and the Royal Aeronautical Society in which he discussed the future of "electrics and electronics" in aircraft and guided missiles.

This lecture inaugurated a scheme for meetings between the two organisations in both London and the provinces produced by a joint committee formed to consider methods of stimulating discussion on electrical engineering and aircraft construction problems affecting aircraft electrical equipment. Much good should come of these informed meetings, especially since they are designed to interest technicians as well as aeronautical and electrical engineers. The interest should not be confined to those in the aircraft industry, however, for just as aircraft system designers consider using techniques and equipment developed for other purposes, so can the results of intensive development work to overcome aviation difficulties be applied elsewhere.

THEORY AND PRACTICE

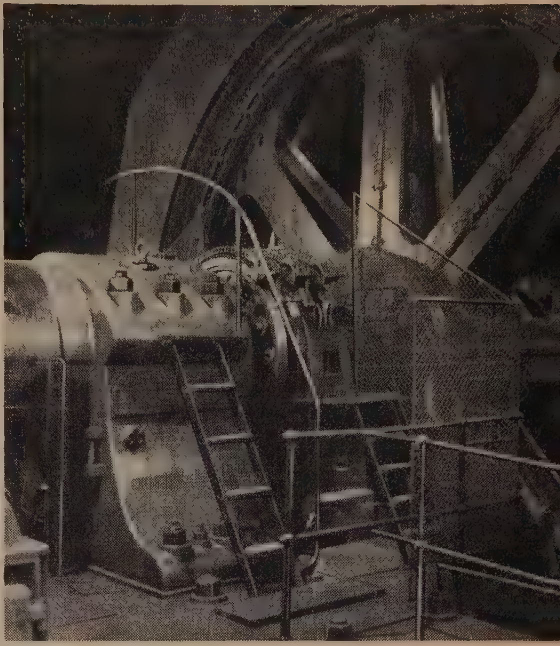
Workshop training is manifestly essential for technicians but it is sometimes thought that it is less important in the case of technologists or of engineers who are more concerned with principles and planning than with the details of production. That is not the view of Sir Christopher Hinton, chairman of the Central Electricity Generating Board, who, for all his eminence, gladly acknowledges the benefit he derived from his time on the shop floor before he proceeded to Cambridge. Addressing the apprentices and pupils of W. H. Allen, Sons & Co., Ltd., at their annual prize-giving, he mentioned instances in which men with little or no practical training, but with excellent academic qualifications, had secured responsible positions in engineering. This should become increasingly rare as "sandwich" methods become the standard form of education and training for both technicians and technologists.

Only those who have been through the mill can have a proper "feel" of what is involved in the execution of an engineering job. Others may be prone to specify the impossible or at least to propose methods which practical experience would have taught them were not the best course.

Individual *versus* Group Motor Drives

By J. R. BARRATT, A.M.I.E.E., and M. HOLLAND, A.M.I.E.E.*

Although they are not suitable for all applications, there is an increasing tendency for group motor drives to be used in place of individual large motors driving through mechanical connections for many production lines. In this article the authors consider some of the principal factors influencing a decision between the two forms of drive


This 5,000 h.p. slipring induction motor drives an 18in and a 21in billet mill through gearing

THE last 50 years have seen a considerable change in industrial drives due largely to the availability of electric power, and the development of a large range of electric motors of improved efficiency and performance, and for use under hot, wet, dusty and explosive conditions. Good reliability is now obtained with minimum maintenance. These improvements have occurred simultaneously with demands from industry, to secure increased production with varying degrees of automation, which is becoming fully established in the light engineering and motor car industries, but only to a lesser extent in the steel industry because of physical limitations. Great advances have, however, been made in this direction in the steel industry due to improved control equipment and greater reliability of the mechanical equipment. Even so, there is still one steel rolling mill in the Sheffield area which, until recently, was operating from a water wheel and a number are still driven by steam engines.

The conditions affecting the choice of individual or group motor drives are many and varied, but tend to favour the individual motor drive. Initially, the group motor drive would be generally accepted because it could replace a steam engine or even a water wheel as the prime mover. The limitations would be the size of the motor and the availability of the required power. This decision might be taken in the older engineering and steel industries because a system of line shafting would already have been installed to be the prime mover for the various machines. Similarly, the machines would have been designed to accept their power from a common line shaft from the viewpoint of stopping, starting, speed control and overload characteristics. In smaller industries, however, a large number of hand- or foot-operated machines gave the manufacturers the opportunity to develop the smaller motors for individual drives. Half-a-century ago the conception of the drive for a new plant was given primarily by power requirements and the availability of motor sizes and equipment designs.

Layout

The conception of the drive in a modern plant usually has to take second place to the layout of the mechanical equipment which, in turn, is governed by the process flow and handling facilities. This means that some drives may be at right-angles to others, some vertical, some widely spaced and some congested. The use of a group drive in such cases is often precluded or else, of necessity, broken down into a number of smaller group drives. Overhead electric cranes rule out overhead line shafts with belt drives. Bevel gear drives to heavy roller tables are, however, still accepted practice, due to the load-sharing properties which are more pronounced when short, heavy sections have to be traversed down a long roller table. The bevel gear drives of the older tandem steel mills have become obsolete through the necessity of fixed draughting at each stand. The draughting, which is determined by the speed increase provided by the bevel gears at each successive stand, cannot be accurately obtained and material pulling results. With the group drive on a mill the draughting or process material reduction is constant, providing that there is no bearing wear and roll diameter has remained constant. In practice, this cannot occur and with a fixed speed drive the processed material tolerances must be affected.

The increased use of contactor equipment requires an enclosed, clean area, away from the working conditions of the process and it is usual to house the drive motors where possible with the control equipment. This means that open, well-ventilated motors can be used, with reduced maintenance and increased accessibility. Motors adjacent to the process can be pipe ventilated to keep the machine working under good atmospheric conditions.

Drive and Control Characteristics

One of the main advantages of individual motor drives is the fact that the motor output is as near as possible to the driven machine, giving a considerable gain in the elimination of mechanical friction in line shafting, gear trains and connecting shafts. Control of multi-motor equipment involves the electrical engineer in higher capital expenditure, greater complexity and greater maintenance responsibility. The last is offset by increased

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* Steel, Peech & Tozer.

Individual drives in the motor room of a modern strip mill

reliability of control gear components, although much still remains to be done.

Individual drives have now become standard in multi-stand rolling mills, giving the mill increased flexibility. In all coupled mills where the material being processed passes through more than one stand, d.c. drives are essential, and are now being fed from transformer-rectifier units. One of the last hot strip mills to be commissioned has the final rolling stands controlled from two 3,500 kW rectifier units with the transformers fed at 11 kV and a working d.c. voltage of 600 V. These rectifiers can be operated together or as separate units, being controlled on d.c. busbars with bus section switches. Individual drives from this rectifier can be speed matched automatically or trimmed by rheostats in the motor fields which give a quick and accurate response.

Before 1950 the accepted Ward-Leonard drives were fed from motor-generator sets, with one generator feeding many motors to give the combined drive, or with a separate generator for each motor. The development of rectifier equipment and the increased ratings available have resulted in the equipment supplanting the generator. This has eased the task of electrical maintenance engineers and the reliability of these units has brought back the use of the d.c. drive. When they are used in conjunction with phase shifters for grid control, magnetic amplifiers being used as the response unit, the mercury-arc metal tank rectifier becomes a very useful and adaptable unit. Perhaps the development of variable-frequency equipment with an induction regulator will replace the d.c. drive by the more robust a.c. induction motor, a machine more suitable for the arduous working conditions being imposed on electrical machinery.

Direct current gives the accurate speed and tension control required, braking under all conditions requiring a simple, dynamic control. Reversing control can be a light current duty compared with a.c. starting currents. The machine overload characteristics can be matched to its own drive and catered for electrically, but with a group motor drive some mechanical overload device, such as a shearing pin or slipping clutch, must be fitted to avoid damage to the costly components of the drive. One disadvantage of the multi-motor roller conveyor drive is the possibility of a particular motor being subjected to overload should the material being handled not be shared on the roller drive. This is obviated in a single-motor drive with the mechanical sharing of the load. From the maintenance point of view, the small multi-motor drive gives much greater flexibility when considering motor spares. With control gear, the American type of maintenance using plug-in contactors does not seem to be favoured by the British electrical engineers, but this is probably decided more by economic than engineering considerations.

Cabling

As each drive and machine becomes more complex with the advent of contactor control gear, the cabling costs must rise. On single-motor drives the use of drum controllers and associated resistance banks cut cabling to the minimum. Much can be done by forethought on complicated control schemes by manufacturers siting associated equipments as close together as possible, so that a packaged control unit emerges, where six or seven wires to the motor and control buttons are the only cables on the machine. The tendency to place electrical control gear away from the plant in a clean atmosphere is now generally accepted. Where practicable the use of unarmoured p.v.c. cables, with a plastic sheath where damage cannot occur, also helps to reduce cable costs considerably. The use of p.v.c. cable has made the work of the wiring contractors considerably easier.

Busbar systems, with each drive protected by miniature circuit-breakers, are now being used and the group drive is controlled collectively. This method can be used for both a.c. and d.c. multi-motor drives. Small, individual drives can be finally connected by plug and socket as this assists the speedy replacement of faulty machines. The use of switched sockets gives protection to maintenance staff when changing motors and keeps the stop time to the minimum.

Power and Load Factor

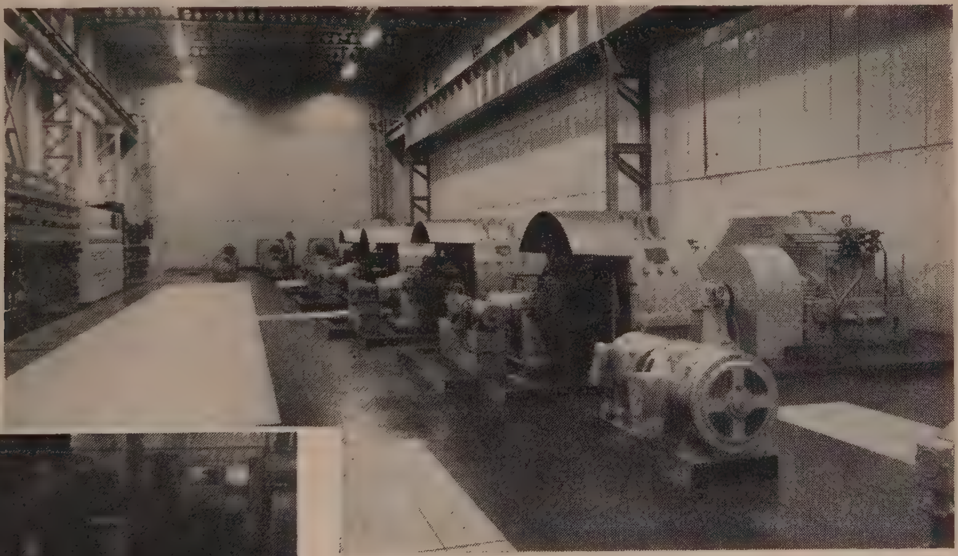
The power factor of a single machine is usually better than that of a group of smaller machines. On large a.c. drives with constant speed and load, the synchronous motors can be designed to operate on slightly leading power factor to give an overall power factor improvement for the factory. Power factor control on synchronous machines with variable load can easily be effected automatically by varying the excitation to match the load demand of the drive. Large d.c. drives can be supplied from rectifiers with tap-change transformers to keep the power factor approaching unity. Ward-Leonard and Ilgner sets driven by synchronous machines for power factor improvement can also be used.

On multi-motor drives, the average power factor can be improved by the use of static capacitors. On such drives of small horse-power the best correction method is the use of a capacitor for the group. Each motor can be corrected separately on larger a.c. drives of 50 to 100 h.p. Very low speed a.c. motors have a poor power factor, and power factor correction can show an economic saving in reducing the size of the supply cable to that group. The load factor is improved with smaller machines or multi-motor drives, as any part of the machine can be easily disconnected if required with a saving in electrical consumption.

Automation

Although the word automation has only recently been added to the vocabulary, the addition of an electrical drive to hand-operated equipment is the first step towards full automation. The extent to which it can be carried is dependent on the availability of suitable control equipment, and the complexity of the process. A machine tool on repetition work lends itself to automation, but on a process line containing many varied operations, it may require a computer to replace the human control element. Individual drives to each item of the process line mean that an operator or operators can control the process from a central point, providing the instrumentation is sufficient to indicate the effect of the controls.

The next stage is a feed-back system from the drives to suitable control equipment so that any deviation from the initial settings can be corrected. If the process is repetitive and the initial settings can be left unchanged for a considerable time, then this is full automation and the controls can be left unattended. If, as in the case of a rolling mill, the process is a cogging mill preceded by ingot soaking pits and the melting shop, the programme may require frequent alteration to suit the output of the melting shop and the soaking pits. This may mean that alterations to the initial settings occupy a large proportion of the individual running time. Individual drives on each item of equipment on the process line mean that gradual



Right: Four of the six drives in finishing mill of Brinsworth strip mill

Below: Some of the gearing involved in a single motor drive is seen during the assembly of a reversing mill roller table automation of each item can be effected. With a group drive this would be a difficulty as, for example, the group drive on a tandem mill where the ratios of the gearing determine the reduction that can be made at each pass. Unless the gearing is variable, the system is inflexible.

The addition of induction clutches can be used to impart variable speed control to a number of units from a common drive. Although at the present time these clutches are rather limited in the amount of power they can transmit, larger units are under development. The degree of slip that the rotating members can tolerate at high induction currents, however, poses a difficult heat transfer problem, even with modern insulators, if water cooling is to be avoided. They have some of the advantages of a group drive without some of the disadvantages of the individual drive, but the common line shaft may be a deterrent for a large number of drives.

Economics

It is difficult to make a general assessment of the economic advantages of the two types of drive, as so many factors have to be taken into consideration. In the simple case of replacing a prime mover with one large motor for a number of small motors, the capital cost can easily be obtained for each case and similarly the running costs. More often the problem is to install an extra item of equipment in an existing plant or else to install a number of pieces of equipment in new plant with provision for later expansion. In the first case even if a group drive exists, there sooner or later comes the stage where it is overloaded and a decision has to be made to replace it with a larger motor or retain it and start installing individual drives. In the latter case it is dependent on the type of process and the degree of expansion involved.

On large multi-motor drives the foundations and building costs involve heavy capital expenditure compared with a single-motor drive. This has to be balanced with increased flexibility and improved final product. In many cases, however, packaged equipment complete with motor and starter is the only available standard equipment and is often substantially cheaper than individually engineered equipment. In the case of a process line, however, it should be borne in mind that a motor failure on one item of plant can often shut the line down just as effectively as the failure of the prime mover of a group drive.

Control equipment developments can be utilised only if the choice of the drive equipment has been correctly interpreted to take advantage of the modern automatic systems. With the ever-increasing demand for better finishes, tolerance and quality, greater flexibility in the machine gives the operator the facility to produce a wider range of finished products.

The authors wish to thank Steel, Peech & Tozer for permission to publish this article and photographs.

Tariffs in Southern Rhodesia

FROM OUR SALISBURY CORRESPONDENT

AN exhaustive inquiry into tariffs was recently conducted in Salisbury, Southern Rhodesia by the Southern Rhodesia Electricity Council.

At the end of 1958, the Electricity Supply Commission applied to the Council for permission to increase tariffs, but the application was successfully contested by the largest single consumer group, the Chamber of Mines. This led to an amending Electricity Act giving the Minister of Power greater powers in approving tariff increases, and culminated in an interim surcharge of 5 per cent applied in February, 1960, pending a fresh application by the Commission.

The Chamber's case, apart from certain legal argument, rested upon inequity and the unfairness of increasing tariffs to power users by a greater amount than to farmers and municipal bulk purchasers. As a result the Commission secured the services of Messrs. Kennedy & Donkin to investigate and report upon the whole question of cost allocation, tariff design and cost structure, bearing in mind the changing conditions that would gradually come about as greater amounts of power were purchased by the Commission from Kariba. On behalf of Messrs. Kennedy & Donkin, the investigation was made by Mr. D. J. Bolton, who prepared a report.

Based upon this report, the Commission submitted revised proposals containing a new set of tariffs designed on this new cost structure and to eliminate inequity between classes of consumer. At the hearings recently concluded, the Commission was required to produce details of all the data which were used in the formulation of the various tariffs for different classes of consumers. The Electricity Council not only required all this data relative to standard tariffs but full details of tariffs, revenue, loads and average prices of the few special tariffs offered to very large consumers.

The main objectors were the Chamber of Mines, the six municipal bulk purchasers and the Rhodesia National Farmers' Union. As often happens in such cases the various objectors spent considerable time in endeavouring to show that the group they represented was not the group responsible for the present accumulated deficit of £1,500,000. It has recently been announced that no objector was successful and the revised tariffs as proposed have been accepted *in toto*.

It is now hoped that this tariff revision will enable the Electricity Supply Commission gradually to attain an even keel and correct the adverse trading balance that has been a feature of its operations over the past seven years.

Electronic Telephone Exchanges

A CONFERENCE on electronic telephone exchanges, arranged by the Electronics and Communications Section of the Institution of Electrical Engineers, began in London last Tuesday and concluded yesterday. The conference was divided into five sessions covering time-division-multiplex exchanges and space-division systems. Yesterday some of the participants visited the Post Office Research Station, Dollis Hill, to see a model electronic exchange.

Domestic Heat Pump

TRADITIONAL designs and methods die hard in the building industry. New houses are still being built with inadequate initial heating facilities, so that the eventual cost of installing an efficient system is extremely expensive. New developments in civil engineering techniques are rarely applied in domestic houses and the number of electric socket-outlets is usually inadequate.

A businessman, Mr. Vernon Mills, connected with financing new housing developments was appalled at the designs and constructions of new houses for which he was asked to advance loans. He therefore decided to produce his own designs and formed Jonmil Building Developments, Ltd. Three designs of houses are at present available, and each incorporates new civil engineering techniques. One of these houses, the " Rancher," has a heating system incorporating a heat pump.

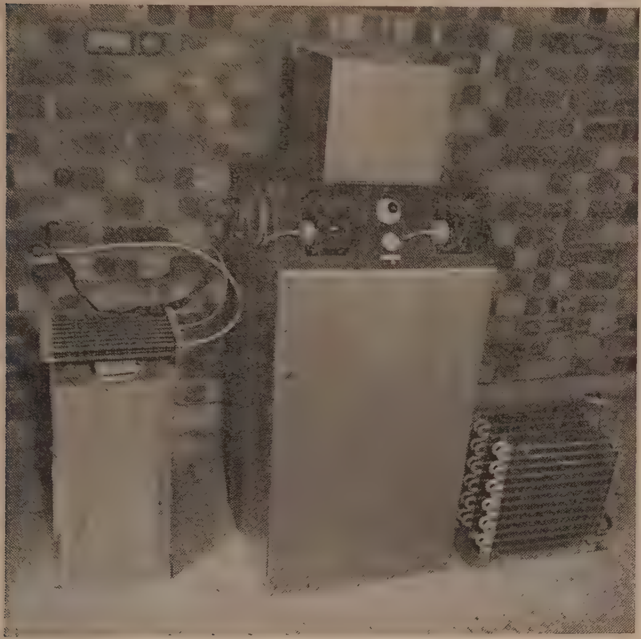


Fig. 1.—Jonmil-Demat heat pump

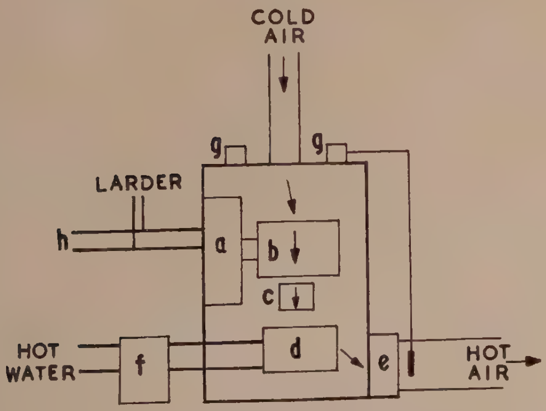


Fig. 2.—Jonmil heat pump Mark II

(a) Compressor unit. (b) Hot radiator or condenser. (c) Fan. (d) "Boiler". (e) 3 kW booster heater. (f) Auxiliary hot water cylinder. (g) Thermostat. (h) Connection to other evaporators. NOTE :—The manual control valve governing the use of the auxiliary hot water cylinder is also provided. The dehumidifier and the air cleaner at the cold air entry to the unit are not shown.

Fig. 3.—The living room in the "Rancher" showing the hot air outlet duct beneath the bookcase

Various heat pumps which have from time to time been on the market have all been designed for installation in existing houses. The Jonmil heat pump is designed for incorporation during the building of a new house. It is made up from standard refrigerating and ventilating units and is arranged to transfer heat from the cold air outside the house and the cooled larder to the hot air heating and water systems. The main unit, Fig. 1, consists of an electrically driven two-cylinder compressor, fitted with autoguard and starting relay. The sealed system contains about 15 lb of methane refrigerant, which is allowed to expand from 150 to 5 p.s.i. through a special valve. The compressor is driven by a 1 h.p. single-phase motor at 1,400 r.p.m. and can handle 3 lb/min of refrigerant. The heat flow is about 12,000 B.Th.U./hr (equivalent to about 3 kW) and is obtained by the use of a compressor rated at 0·8 kW.

The main components of the system are shown diagrammatically in Fig. 2. Cold air from outside enters the unit via a dehumidifier (Danfos silica gel dryer) and air cleaner, and passes over the hot radiator or condenser bank and, in the Mark II unit, through the hot water " boiler." The hot air is then exhausted to the ducting system by a small fan incorporated with the condenser.

A 3 kW booster heater is also fitted in the air ducting for use in severe weather and when starting the system from cold. One evaporator is situated in the cooled larder, while supplementary evaporators are installed in the garage. Two thermostats are fitted to the system, one of which is connected to the hot air outlet duct and controls the booster heater. The other thermostat has its sensing element in the larder. The auxiliary hot water cylinder is connected in to a conventional domestic water system.

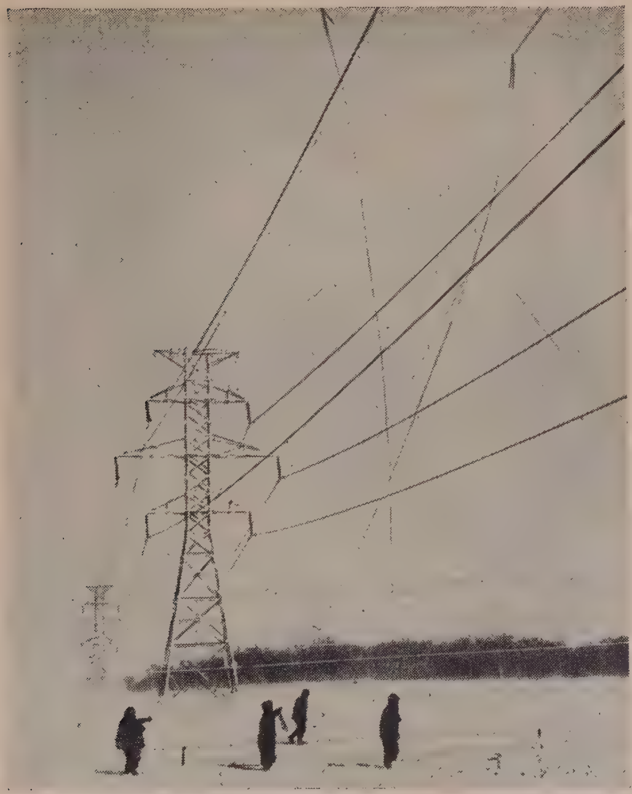
It is claimed that this system will be able to provide a refrigerated cupboard, central heating and a hot water supply for about 14s per week. The " Rancher " can be constructed by any builder in the United Kingdom under licensing arrangements which provides for complete plans and construction details. Cost, without land, is from £3,350. Details can be obtained from Jonmil Building Developments, Ltd., 16, Carlisle Street, London, W.1. The architects are Favel, Bellis & Associates.

Although the heat pump is intended primarily for installation in new buildings, it will shortly be available through electrical contractors for installation in existing houses. The Mark I unit, without the water heating "boiler," will cost approximately £220, including installation. The cost and installation of the Mark II unit is approximately £250. A same-day maintenance service will be provided.

Transmission Line Icing

FROM A CORRESPONDENT

DURING a spell of severe weather last winter in the Canadian province of Ontario particularly heavy icing was experienced on overhead transmission lines. Immediate steps had to be taken to reduce the ice loading otherwise it was feared that failure of the lines or towers might take place. One method, which was successful in removing 600 tons of ice from two high-voltage circuits, was to feed some 1,300 A, twice the average normal load, into the circuits from the Des Joachims power station.



Protected against the cold weather, maintenance men of the Ontario Hydro-Electric Power Commission pull chains along the overhead lines to break away ice formations

Previously the eight generating units of this station had been isolated from the overhead distribution system. The output from the generators was then transmitted at 230 kV for some 93 miles before the 1,300 A current was fed in two successive operations into two single ice-covered circuits. Whilst it is not universally possible for the overhead system to be isolated nor is the current always available it was successful in this instance in removing ice which was between 2 and 3in thick in about three-quarters of an hour.

A different method was used to remove ice from the earthed topmost lines. So heavy was the ice loading on these lines that when pieces of ice broke off, the earthed line bounced up and down, causing short circuits. Chains attached to ropes were placed over the lines and as the ropes were pulled along from the ground the chain was pulled up and down from each side alternately so that the ice was cut off the cable. An alternative method was to use a hook which was attached to the cable and once again pulled along by ropes.

Difficult as these operations were, especially when they were carried out under extreme weather conditions, the removal of the ice prevented the breakage of the cables under the heavy ice loading.

S.I.M.A. Convention

THE ninth annual convention of the Scientific Instrument Manufacturers' Association (S.I.M.A.) was held at the Grand Hotel, Eastbourne, from 17th to 20th November. As with previous conventions held by the Association, the main purpose of the event was to provide an opportunity for instrument manufacturers and users of instruments to meet and discuss their various problems. The main theme of the proceedings was productivity as it affects the British scientific instrument industry and the broad topics covered were design, management, floor production and sales.

The convention was opened by Mr. G. C. Ottway, president of S.I.M.A., after which the delegates divided to attend whichever of the four simultaneous meetings interested them most. At the meeting dealing with design, which took place under the chairmanship of Dr. A. C. Menzies (Hilger & Watts, Ltd.), the first session was concerned with designing instruments for scientists and Professor R. V. Jones (University of Aberdeen) opened the discussion with a most interesting address.

The second session was opened by Mr. H. Upjohn (Council of Industrial Design) who outlined the history of industrial design and gave reasons why a new art form has been evolved. Dr. Stephen Black (Medical Research Council) then spoke about ergonomics which is the anatomical, physiological and psychological study of man in his working environment and may be summed up as "fitting the job to the worker." He gave an account of the possible application of the use of hypnosis in the unconscious analysis of design in ergonomics. Dr. Black gave an evening demonstration of the techniques he employs in this respect. The final session was opened by Mr. A. H. Willoughby (G.E.C.) who spoke on designing for production as applied to electric lamps.

Other meetings at the convention were concerned with management, sales and floor production.

IMPULSE TESTING OF POWER TRANSFORMERS

By A. PEDERSEN, M.Sc.(Eng.)*

The difficulties encountered in generating the standard 1/50 µsec impulse voltage wave when testing large power transformers are discussed. It is often impossible to obtain the standard 1 µsec wave-front within the allowed tolerance, if the winding under test has a high surge capacitance. It is suggested that the upper limit for the duration of the wave-front should be allowed to increase proportionately to the square root of the surge capacitance when testing h.v. windings and surge capacitances exceeding 2,000 pF, if the nominal maximum value of 1·5 µsec cannot be obtained

AN important factor in the design of power transformers for high-voltage transmission systems is the response of the windings to surge voltages caused by lightning strokes. These surge voltages are characterised by a rapid rise to the peak value followed by a relatively slow fall to zero, i.e. by a front of high equivalent frequency and a tail of low equivalent frequency. When considering its response to surge voltages the winding can be represented by a network of inductances and capacitances as shown in Fig. 1.

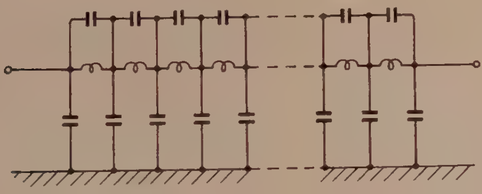


Fig. 1.—Equivalent diagram of a transformer winding

The inductive elements represent the inductance of the winding, and the capacitances the distributed series and earth capacitances. During the front of an incident wave only a negligible current can flow through the inductive elements, and the voltage distribution is controlled by the capacitive network alone. The larger the earth capacitances are relative to the series capacitances, the more non-uniform is the initial voltage distribution. After the peak of the wave, current starts flowing through the inductances, and the voltage distribution is finally governed by these. The difference between the initial and the final voltage distribution causes a sequence of transients, which can result in severe voltage stresses within the winding.

The technical problems associated with these surge phenomena can be solved in many different ways. By stress control, which means that the insulation is dimensioned to control and withstand the stresses which appear across it; or the initial voltage distribution can be improved by use of appropriate electrostatic shields, by use of layer-type windings or interleaved disc windings.[1–4]

The way in which the problem has been approached does, however, greatly influence the surge capacitance of the winding. Whereas it may be only a few hundred picofarads for a conventional disc winding, it may appear to be several thousand picofarads in the case of an interleaved disc winding. This high surge capacitance will often introduce difficulties if the winding has to be impulse tested, because of the limitation imposed on the steepness of the front of the applied wave by the high capacitance of the test object. This fundamental difficulty is discussed below.

Standard Impulse Waveforms

To prove that a transformer is capable of withstanding the surge voltages to which it may be subjected during service, impulse tests are frequently carried out. Impulse test levels and standard wave shapes to be applied are laid down in various international and national standards or recommendations.[5–7]

The standard impulse wave at present in use in Europe is the 1/50 µsec wave as specified by the International Electrotechnical Commission.[8] This wave is shown in Fig. 2. The nominal duration of the front is defined as 1·25 times the time interval between points on the front where the voltage is 10 per cent and 90 per cent of the peak value. The nominal start of the wave is determined by the intersection of a line drawn through these points and the time axis. The wave tail is characterised by the time to half value on the tail measured from the nominal start. The standard front time is 1 µsec, and the standard time to half value is 50 µsec. The tolerances allowed are, respectively, ± 50 per cent and ± 20 per cent.

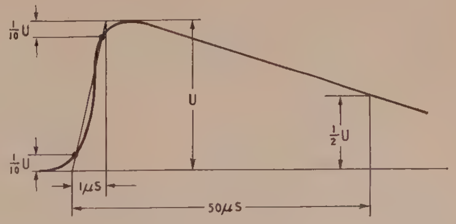


Fig. 2.—The I.E.C. standard 1/50 µsec impulse test wave

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* Formerly of the English Electric Co., Ltd.

The definition of the I.E.C. standard impulse wave is being reviewed by an I.E.C. committee. This will probably result in minor alterations which, however, will have no influence on the problem dealt with in this article.

The American standard wave is a 1·5/40 μsec wave,[6] as shown in Fig. 3. The duration of the front is defined as the time from nominal start to the actual peak of the wave. For convenience in measurement this time may be considered as 2·0 times the time interval between points on the front at 30 per cent and 90 per cent of the peak value. It is required that the front shall not exceed 2·5 μsec and the time to half value shall not be less than 40 μsec.

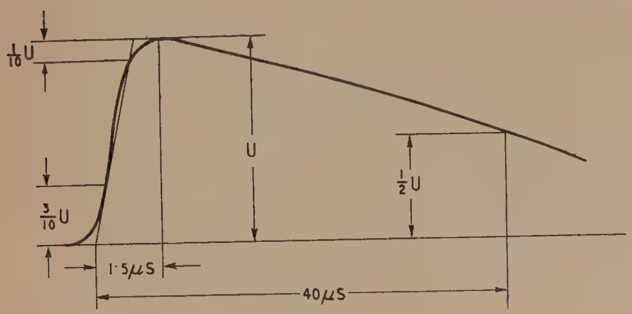

Fig. 3.—The A.S.A. standard 1·5/40 μsec impulse test wave

Obtaining the Standard Wave

A schematic diagram of the circuit normally used for impulse tests on a power transformer is shown in Fig. 4 where C_1 is the equivalent capacitance of the impulse generator. R_1 and R_2 are the resistances which control, respectively, the front and the tail of the wave. The transformer winding is represented as a capacitance C_2 in parallel with an inductance L_2. The capacitance C_2 is the surge capacitance of the winding and includes the capacitance of the bushing and any other capacitance acting as a load on the impulse generator. L_2 is approximately equal to the short circuit inductance of the winding. The inductance L_1 represents the inherent inductance of the impulse generator and the inductance of the external leads.

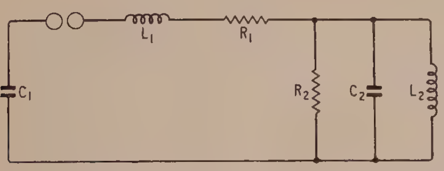

Fig. 4.—Schematic diagram of impulse test circuit

The impedances of the winding represented by C_2 and L_2 have a considerable influence on the form of the applied impulse wave, and it can be extremely difficult and in many cases impossible to obtain a wave shape within the limits prescribed in the specifications.[9–13]

For a non-oscillatory circuit the front time is approximately determined by:—

$$T_f = 2{\cdot}5 R_1 C_2 \quad \ldots \quad \ldots \quad (1)$$

This means that the series resistance R_1 is inversely proportional to the load capacitance C_2. To ensure absence of oscillations R_1 must, however, be greater than or equal to the critical resistance of the circuit, i.e.

$$R_1 \geqq 2\sqrt{L_1/C_2} \quad \ldots \quad \ldots \quad (2)$$

This implies that there is an upper limit to the load capacitance for which it is possible to obtain a certain fixed duration of the front.

For a high capacitance load the shortest front is obtained when the impulse plant operates at the oscillation limit. For the critically damped circuit the front time is approximately

$$T_f = 2{\cdot}1\, R_1 C_2 \quad \ldots \quad \ldots \quad (3)$$

or by substituting R_1 from equation (2)

$$T_f = 4{\cdot}2\sqrt{L_1 C_2} \quad \ldots \quad \ldots \quad (4)$$

i.e. the shortest possible front time is proportional to the square root of the load capacitance. A slightly shorter front can be obtained by allowing a limited amount of oscillations on the crest.

The value of the circuit inductance L_1 depends on the height of the impulse generator, the number of stages, and the length of the external circuit.[14] The inherent inductance of modern impulse generators is about 3 to 6 μH per stage. The inductance of the external circuit can be set to approximately one microhenry per metre circuit length. High test voltages necessitate certain minimum geometrical dimensions in order to obtain the clearances required by the test voltage. This implies that the circuit inductance cannot be arbitrarily reduced. For test voltages of the order of one million volts the circuit inductance will normally be somewhere between 50 and 100 μH. The maximum load capacitance for which it is possible to obtain a front time of less than 1·5 μsec then becomes approximately 2,000 pF. For lower test voltages the total length of the circuit and hence the inductance can be considerably reduced, and the maximum capacitance for which a 1·5 μsec front can be obtained will be correspondingly higher.

The surge capacitance of high-voltage windings varies within wide limits according to the design. It may only be a few hundred picofarads for a conventional disc winding, but can be considerably in excess of 2,000 pF in the case of a shielded disc winding of the non-resonating type, a layer winding, or an interleaved disc winding. It is, therefore, often virtually impossible to apply the I.E.C. standard impulse wave within the allowed tolerances to one of these types of windings with improved initial voltage distribution.

The surge capacitance of a transformer winding does, however, also influence the rate of rise of voltage which can actually occur across the winding during service conditions. High voltage windings will normally be connected to a line with a surge impedance of 400 to 500 ohms. This limits the shortest possible front for a capacitance of 2,000 pF to about 2 μsec. For higher capacitances the shortest possible front will increase almost proportionately to the capacitance. It would, therefore, appear to be justifiable to increase the tolerance on the wave-front of the I.E.C. standard impulse wave for tests on high-capacitance windings. Remembering that the shortest possible front time is proportional to the square root of the load capacitance, this could be done in a simple way by specifying that the front time should not exceed 1·5 μsec, except for high-voltage windings of higher surge capacitance than 2,000 pF, for which the front time should be allowed to increase proportionately to the square root of the capacitance. The apparent surge capacitance of the winding can easily be evaluated from the circuit parameters and the wavefront actually obtained.

It can be argued that high-capitance windings will then be subjected to less severe tests than windings of more conventional design. This will, however, not be the case if the tests include the application of chopped waves, as is required in the American Standards Association specifications and in the British Electrical & Allied Manufacturers' Association recommendations.[6–7]

This fundamental difficulty in obtaining a fast enough front has to some extent been taken into account in the A.S.A. specifications,[6] which allow a longer front for high-capacitance windings. To demonstrate that the long front time is caused by a high capacitance, it is specified that the impulse circuit series resistance should be reduced, which should cause superimposed oscillations. Only the inherent generator and lead inductances should be in the circuit. A decision based on this clause will, however, necessarily be rather subjective.

Concerning the length of the wave tail, difficulties are often encountered when testing large power transformers. With reference to Fig. 4 the maximum time to half value which can be obtained, when R_1 is zero and R_2 infinity, is approximately:—

$$T_h = \sqrt{C_1 L_2} \qquad \ldots \quad \ldots \qquad (5)$$

The inductance L_2 is proportional to the square of the system voltage and inversely proportional to the kVA rating. The difficulty in obtaining a long enough tail is, therefore, more pronounced for low-voltage windings of high kVA rating.

The duration of the tail can be increased by earthing the terminals not under test through suitable resistances which will limit the voltage appearing on them to a safe value, for example to less than 75 per cent of the full wave test level for the associated winding. The capacitance of the impulse generator will, however, always be the main factor which limits the time to half value. It is, therefore, an economic question rather than a fundamental one whether the standard requirements can be met or not.

It is, however, questionable whether it is justifiable to increase the impulse generator capacitance to such an extent that the required tail can be obtained even for the low-voltage winding of a large generator-transformer, as such a winding will probably never be connected to exposed lines. It seems more reasonable to adopt the American practice,[6] which allows such windings to be tested by inserting a resistance of the order of 50 to 500 ohms in the earthed end of the winding under test. It can, however, even with this arrangement, be rather difficult to obtain an acceptable wave shape with a conventional impulse circuit. In such cases better wave shapes are often obtained by using special circuits in which the front is controlled by inductance and resistance instead of by resistance and capacitance.[10]

Acknowledgments

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MOTOR DIMENSIONS

THE first British Standard to lay down dimensions of electric motors, B.S. 2083, was published in 1954 and dealt with totally-enclosed machines. Since that date, motor dimensions have been continually under review. In 1958 a further British Standard, B.S. 2960, was published to cover motors with ventilated enclosures and conformed much more closely to the standards of other countries and the recommendations of the International Electrotechnical Commission. The dimensions for totally-enclosed motors have now been revised and the pattern of the dimensions established for ventilated enclosures has now been followed. The new standard is being issued as Part 2 of B.S. 2960 and the existing specification will be renumbered as Part 1. Contrary to normal practice, B.S. 2083 will not be withdrawn immediately because the original specification for totally-enclosed motor dimensions found wide acceptance in industry and it is necessary to allow a transitional period during which both B.S. 2083 and B.S. 2960: Part 2 will be in force. It is expected, however, that wherever possible totally-enclosed machines complying with B.S. 2960: Part 2 will be selected.

The new specification gives all the dimensions which affect mechanical interchangeability of foot-, flange- and skirt-mounted three-phase, 50 c/s, totally enclosed fan cooled squirrel cage industrial motors within the range 1 to 50 h.p. In addition, an appendix gives information regarding the overall size of the motors to help designers to assess the space required by each machine. Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 7s 6d.

Capital Investment and Government Control

By D. J. BOLTON, M.Sc.(Eng.), M.I.E.E.

The Government White Paper on Public Investment reviewed in our issue of 4th November has now been followed by a two-day debate in the House of Commons. This article describes how the electricity supply programme is prepared and presented to the Government, and discusses in what way and to what extent the Government is able to control the capital growth of the industry

THE question of the proper control of the nationalised industries is as old as the nationalised industries themselves. In the flurry of nationalising activity that occupied our legislators in 1945 and the following years there was common agreement amongst promoters and opponents alike that the new pattern of nationalisation was to be as different as possible from the old, and that the nationalised coal, transport, electricity and gas industries were to be completely unlike the Post Office. Instead they were to be modelled on the London Passenger Transport Board, the Central Electricity Board and other organisations whose governing body was defined by that much-hoped-from word " Board."

The Board was to be a small body of skilled administrators concerned only with efficiency, rather than a large collection of representatives and interested parties. It was to have full responsibility for running the industry without outside interference and with the widest possible measure of commercial freedom. Having passed the Bills in which these principles were embodied, Members of Parliament have, for the most part, accepted the logic of their own enactments and have agreed to such self-denying ordinances as prevent them from interfering with or even asking questions about the day-to-day operations of the nationalised industries.

All this, however, is merely negative and leaves the major question unanswered. It defines what is not to be done but not what is to be done. Clearly there must be *some* guidance and control by Ministers and Parliament or what, it may be asked, was the nationalisation for? Undoubtedly one, major, object of all these enactments was to give the Government a greater measure of control either of certain key industries or of a substantial sector of the nation's economy than was possible with private enterprise. Before considering how this can be carried out it will be well to set down the probable aims of such control.

There are two main purposes which the Government might reasonably expect to achieve with any of these industries, namely a general direction in matters of major policy and a control of the rate and character of development. As an example of the former, it is to be expected that questions of generation policy as regards alternative types and locations of stations, and distribution policy such as rate of rural electrification would be subject to an overriding Governmental control. As regards the latter, the Government's control of the industry's capital investment gives it a convenient means of regulating, accelerating or retarding the rate at which this slice of the nation's capital resources are used up.

Approval of these aims does not, however, preclude a certain obstinate scepticism as to the degree to which they can be accomplished. How far is it technically possible, in the case of our particular industry for, say, power station policy to be effectively directed by Government, even on the very broadest lines? How far is it technically possible for its speed of capital development to be regulated? In order to answer these questions it is necessary to examine some characteristics of the industry including its rate of growth, its programming procedure, and the economics of its power generation.

Growth of Load

Electricity supply is often regarded as the industry with the " built-in " growth factor. This is at once to exaggerate the natural vigour of the industry and to do less than justice to the energy of the workers therein. Electricity supply growth is neither inevitable nor automatic. It is not inevitable since set-backs in the national economy and, in particular, serious trade recessions are capable of halting or even reversing it. Nor is it automatic since it is due in considerable measure to the energy and enterprise of human load builders in the industry itself.

Nevertheless, this conception of electricity supply growth as an irresistible natural phenomenon or ever-rising tide has an element of truth in it. Underneath all the fluctuations, the spurts due to energetic development and the lulls due to inaction or recession there is a hard core of expansion which (up to date) seems irresistible and universal, in all years and all countries alike. One cannot foretell the future but one can point out that all the many forecasts that have been made in the past regarding coming " saturation " have so far been unfulfilled.

In Great Britain the two main load groups are industrial (50 per cent) and domestic (including farm) (34 per cent). The third group, commercial, which—with traction and public lighting—make up the other 16 per cent is so linked with the first two that from the consumption point of view it can be regarded as a function of them. The growth factors in the industrial consumption are increased mechanisation and hence horse-power per worker, increased employment and gradual switch from private generation to public supply. Of these, only the last named can be expected to show early signs of saturation. The growth

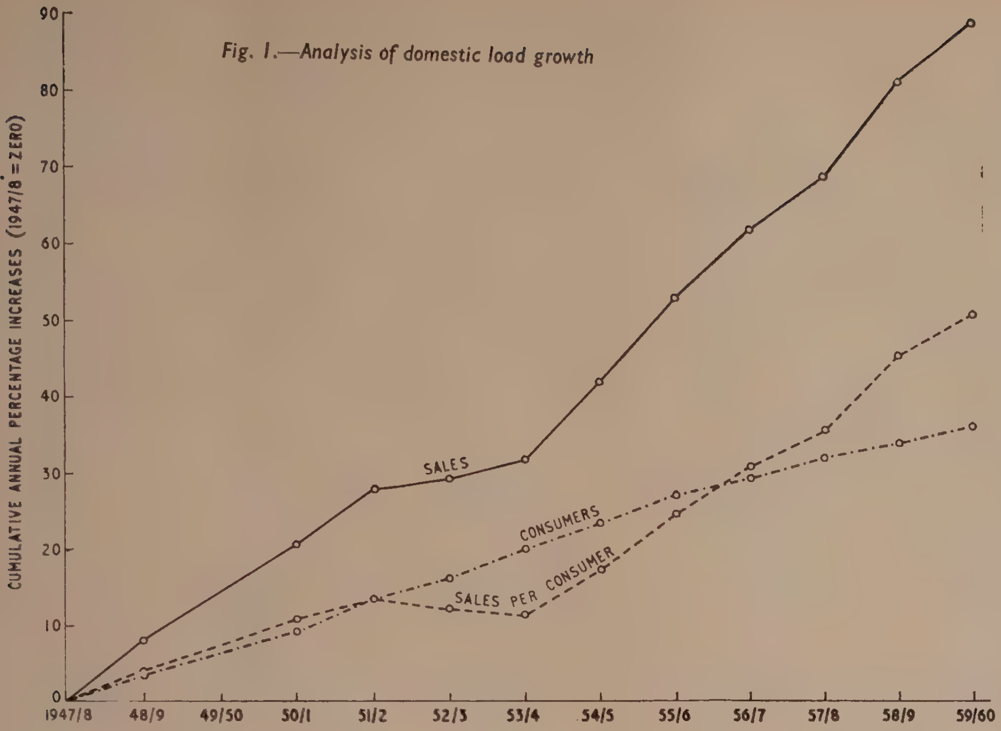


Fig. 1.—Analysis of domestic load growth

factors in the domestic consumption are the increase in the number of electrified dwellings and the increasing electrification of the home. These two can be distinguished statistically by studying separately the number of domestic consumers and the sales per consumer, as is done below.

The overall effect has been an annual increase in electricity sales which seems to have settled down to an average of about 7 per cent, resulting in (almost) a doubling every ten years. The increase has been remarkably consistent and uniform. Ever since detailed statistics were first collected in 1920 there has been an increase in every year except one when, in the 1945 period of industrial re-conversion, sales dropped by 3½ per cent. Over forty years there has been an increase averaging 8½ per cent per annum. Taking ten-year periods from 1920 to 1960, the industry has multiplied its sales in the first decade by 2·4 times, in the second decade by 2·7 times, in the third (which included the war and post-war plant shortage) by 1·9 times and in the last ten years by 2·3 times. To prophesy a doubling in the next ten years would not seem wildly optimistic!

Crystal-gazing is, perhaps, easier with the domestic and farm loads since it is possible to separate out the two components of load growth. In Fig. 1 the annual increases in domestic sales during the last twelve years are analysed into their two components, increases in numbers of consumers and in sales per consumer. (Note: The curves plot the cumulative annual percentage increases over 1947/48 not the total percentage increase. The plotted total is 90 per cent whereas the overall increase per cent of 1947/48 is 140, representing a growth of 2·4 times.) Since the sales are the product of the number of consumers and the sales per consumer, the percentage increase in sales is approximately the sum of the two component percentage increases—i.e. the top curve is the sum of the other two.

The curves bring out two points. Firstly that the increase in sales during the last twelve years has been due in almost equal measure to an increase in consumers and an increase in sales per consumer. Secondly that whilst the consumer increase has been steady (though with a slight falling off in the later years) the sales per consumer increase has fluctuated due to the "ripple" mentioned below, and in two of the years there was a decrease.

The implications for load forecasting are that, since about 95 per cent of homes and 80 per cent of farms now take a public electricity supply, future increases in the number of consumers will arise only from additional housing and the rate can be expected to go down. It does not follow, however, that one of the two almost equal partners in load building will then fade away. The present increase in mean sales per consumer is due to increased electrification of existing homes but the average is to some extent depressed by the other factor, the increase in the number of consumers, since new consumers tend to come in at the bottom of the bracket. Hence with a smaller increase in consumers the average sales per consumer may well increase at a faster rate.

Summing up the position, whilst no one can foretell the load growth over the next five or ten years, this exact knowledge is not necessary for plant programming. The problem there is with the best available estimate to provide plant in such quantities as shall minimise the dangers resulting from the estimate proving inaccurate. In the face of the figures quoted above it would appear imprudent not to provide plant sufficient to meet an annual growth of load of about 6-7 per cent for at least the next five years. (The lower figure would take account of the approaching saturation in the proportion of homes and farms connected.) The chance of plant proving redundant is then certainly no greater than the chance of its proving insufficient, whilst the penalty of redundancy is much less than the penalty of deficiency. Provided, as seems virtually certain, that some annual growth can be relied upon (even though less than was forecast) the penalty of redundancy is at worst only the cost of providing capital a few months earlier than is subsequently proved necessary whereas the penalty of deficiency is compulsory load shedding. Moreover the cost of excess plant is to some extent offset by its higher efficiency.

Load Fluctuations: Weather and Industry

When the load growth is examined more closely it is found that the broad long-term trend of, say, 7 per cent annual increase has two sets of alternations or ripples superimposed upon it. One of these ripples, due to weather variations, has a relatively short periodic time, a few years only. The other, due to trade cycles, etc., may have a much longer period. In planning, it is usual to correct for the effect of the former fluctuation by adjusting each factual figure to its equivalent for a winter involving only " average cold-spell conditions."

So far, mention has been made of only one of the quantities involved in load growth, namely the energy consumption. There is a second quantity, more important to the plant situation, namely maximum demand. In respect of the long-term trend of 7 per cent increase the two have marched fairly close together, the ratio between them (measured by the load factor) having increased only very slightly over the years. But in respect of the short-term fluctuations there is a considerable divergence. Thus if there is exceptionally cold weather during, say, the one peak month of the year the maximum demand for the whole year will be increased thereby, whereas the annual consumption is increased only on account of one month out of the twelve. The tendency then will be for the load factor to be lowered, or, more generally, for the annual demand fluctuations to have a greater amplitude than the annual energy fluctuations.

In planning, the Electricity Boards make estimates of the expected increases both in demand and in energy, assuming average cold-spell conditions. Plant provision is then aimed to cope with the probable risk of departure from this average in the form of increased demand in exceptionally cold weather.

Plant Programming

Whilst for some purposes very long-term estimates are necessary, for purposes concerned with Government control of investment it is not usual to go beyond a five- to seven-year period. Each Area Board makes a sales forecast in the light of its local knowledge of probable future developments and according to certain general assumptions. These estimates are aggregated and integrated to allow for diversity, and the totals are compared with national estimates made by the Generating Board and the Electricity Council.

Based on this pooled body of information the Generating Board determines three programmes of generating capacity: a firm programme for the fifth year ahead, a provisional programme for the sixth year and a tentative programme for the seventh year. Revised forecasts of future load are made in the spring after each winter's peak experience. A factual figure replaces an estimate, future figures are adjusted and an additional year is added at the far end.

Side-by-side with this planning of generating capacity must come the planning of how the capacity is to be made up and where it is to be sited. This will be in accordance with a longer-term plan governing such things as the proportion of nuclear and conventional plant, disposition of stations in relation to site availability, loads and transmission lines. The third stage is to decide what this plant will cost and how the money will be provided. The sequence therefore is—load estimating, plant programming, capital budgeting.

Capital Budgeting

Capital budgeting must relate to the accounting year of the industry which in England and Wales runs from April to March. In December/January each Electricity Board prepares a forecast of capital expenditure, internal resources and borrowing requirements for each of the six years beginning on the following 1st April. In mid-January these estimates are forwarded to the Electricity Council which serves as a central marshalling ground and forum. Consultations between the Boards and the Council are followed by the Council's own review, and about three months later the Council submits to the Minister of Power a consolidated programme for the industry as a whole.

When this has been reviewed by the Minister he gives his approval, in July or August, to the Boards' programmes and to the incurring of capital expenditure of a certain amount (which may be less than the amounts proposed by the Boards) during the succeeding year, and provisional approval for the year beyond that. A year later the process is repeated: the provisional figures (varied if necessary) become approved and a new set of provisional figures is adopted for the next ensuing year.

In a programme which contains many assets taking several years to complete there must inevitably be considerable margin and elasticity. Once initiated, a project acquires a life of its own and goes ahead at a pace only partially controllable by its parents. Even when the approved capital expenditure in any given year is exactly what was asked for, the actual expenditure when it comes can hardly correspond exactly, since it will depend on factors, such as the rate of progress of work, which are largely outside the Boards' control. Moreover, whilst no formal decisions are taken or approval given about the projected expenditure in the years beyond the first two, it is inevitable that on the generation side at least the industry must commit itself to much of this expenditure.

Counter-Cyclical Control

During the last five years the proportion of the gross national product taken up by public investment has remained fairly constant at around 7½ per cent. (The proportion invested in electricity has been rising and is now about 1½ per cent of the national product.) Thus the Government now has in its hands the control of a sizeable slice of the country's investment. But the position regarding trade cycles has altered considerably since the nationalised industries were set up. At that time the Government foresaw the use of public investment as an instrument of employment policy: in the words of the 1944 White Paper on *Employment Policy* (Cmd. 6527) " for the purpose of maintaining general employment it is desirable that public investment should actually expand when private investment is declining and should contract in periods of boom." Since this time the dangers of mass unemployment appear to have receded almost indefinitely and the problems of this country today are primarily those of expansion and price stability.

Moreover, in the case of supply industries like electricity which serve basic economic requirements, there are very narrow limits to the use which can be made of investment control in countering the trade cycle. If there is an industrial upsurge that very fact will soon mean a corresponding upsurge in electricity plant requirements. New factories will require new distribution services, larger pay packets will mean increased domestic electrification and in order to feed them both we shall need more power stations. There is no possibility of treating electricity investment, as was sometimes done with road construction in the past, as a sort of unemployment relief measure.

This does not mean that, in dealing with the trade cycle, nothing can be done by way of "ripple control" through regulating electricity supply investment. What it does mean is that only short-term control is possible. A boom can be damped down for a year or two by limiting electricity investment but if the boom continues there must be increased electricity investment to correspond. As an example of these short-term checks and boosts, in 1957 certain steps were taken to moderate a rate of public investment which would otherwise have imposed an excessive strain on resources. A year and a half later a minor recession seemed more likely and by way of pump-priming the Government took action to stimulate the rate of expenditure in certain programmes. For example, Electricity Boards were asked to bring into that year projects planned for a year later.

In short, the position regarding the flow of capital expenditure in electricity supply would appear to be that the Government can modulate it but not moderate it.

White Paper on Public Investment

Periodically the Government present to Parliament a White Paper dealing with the financing of the nationalised industries and other public bodies. The latest of these (November 1960, Cmd. 1203) was reviewed in the *Electrical Review* of 4th November. It gave figures for the levels of investment in the electricity and other industries sanctioned for 1960/1 and 1961/2, and the out-turns for the two previous years. The figures for England and Wales refer to the financial year April to March whilst those for the Scottish Boards refer to calendar years. Previous *Economic Surveys*, 1959 and 1960, gave figures provisionally approved for each following year. Separate White Papers have from time to time given details of the nuclear power programmes.

In March of this year the Government announced their intention to publish information about prospective public investment earlier than in previous years. Even so it is inevitable that the Generating Board's capital expenditure will be almost entirely committed by the time the corresponding White Paper is published. The Area Boards' programmes are neither so long-term nor so inflexible but even in their case the launching and timing of capital projects are largely determined by circumstances not immediately controllable by them.

Whilst the Investment White Paper defined the amounts which the Boards are permitted to spend on the purchase of capital assets it did not give the amounts of Government lending, since the programmes are partly financed out of internal resources, and only the remainder is a call on the Exchequer. In the ten years from 1948 to 1958, 42 per cent of all capital requirements of the Electricity Boards in England and Wales were financed out of their internal resources (chiefly depreciation provisions and annual surpluses) and in the following seven years it is expected to be as high as 48 per cent. Hence, only slightly over half of the sanctioned amounts during that period will have to be borrowed. These Government loans are repayable in equal instalments over 25 years and carry interest on the outstanding amounts. The interest rate is fixed at the time when the loan is made, and in the last recorded year the rate on new loans has fluctuated around the figure of 5¼ per cent. The current rate is 6¼ per cent.

Such loans are, of course, in no sense subsidies to the industry, they are merely an alternative to the floating of loans by the Boards themselves as was done by electricity undertakings in the past. The actual prospective borrowings of the nationalised industries are to be set out in a White Paper to be published in the spring of 1961.

In addition to this year-by-year control of investment levels there is a statutory ceiling to the industry's borrowing powers. In the case of electricity the figures in the original Acts were raised by the Electricity (Borrowing Powers) Act, 1959, for sums borrowed up to March, 1965, to £1,800 million (extendible by the Minister with the approval of Parliament to £2,300 million). It is estimated that the lower limit will be reached early in 1962.

Great Britain Total

The programming procedure described above refers specifically to the Boards in England and Wales representing, in terms of energy sold, about 90 per cent of public supply in Great Britain. Procedure with the Scottish Boards' programmes is broadly similar, with a difference in dates because of the calendar year of account. In the Public Investment White Paper separate figures are given for the Central Electricity Generating Board, the group of twelve Area Boards for England and Wales, the South of Scotland Electricity Board and the North of Scotland Hydro-Electric Board.

In order to obtain a complete picture of the capital investment position Fig. 2 has been prepared. The first column in each pair, labelled "A," represents the net value of the fixed assets at 31/3/60 or 31/12/59 whilst the second column, labelled "I," represents the permitted level of investment in 1960 as set out in the White Paper. The scale in every case is per cent of the total for Great Britain. Thus the heights of the "A" and "I" columns cannot be directly compared, the money scale of the one being 6½ times that of the other—i.e. the national total (written-down) value of the fixed assets is 6½ times the total 1960 investment expenditure.

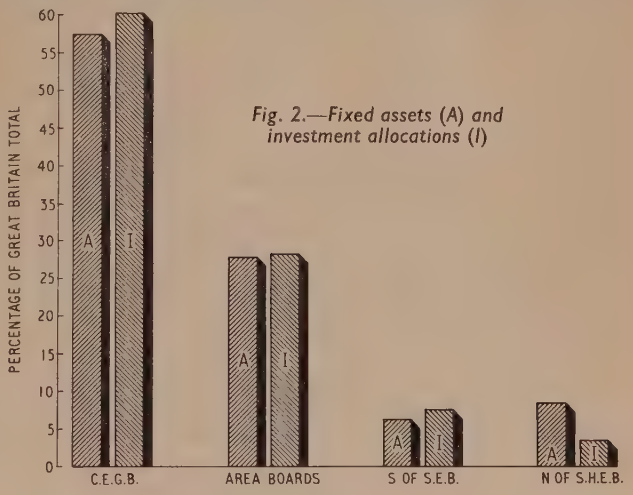


Fig. 2.—Fixed assets (A) and investment allocations (I)

The column heights show the relative amounts of existing assets and new investment in the four groups of Boards. Comparisons of the "I" and "A" columns show how new construction relates to existing equipment.

Limitations to Control

The above description of the mechanism of the Governmental control of the supply industry leads to the question already touched upon, namely the extent to which such control can be effectively exercised. Control can be of two sorts, quantitative and qualitative—i.e. control of the amount of capital investment and control of its character. As regards the former, so long as the public continues to consume each year some 7 per cent more electricity than in the previous year then in the long run something like 7 per cent more equipment must be provided each year. The most that any conceivable improvement in load factor could effect in a year would be to keep down the increase in maximum demand to say 6 per cent instead of 7, and then only for a very limited number of years. It follows that only short-term control of investment rate is possible, and anything like an " Operation Canute " to stem the rising tide would be quite impracticable.

As regards qualitative control, the Government is naturally concerned to see that major policy decisions such as the proportions of expenditure on conventional and nuclear stations, on coal and oil burning equipment and on thermal and hydro power are in the best national interest. But these decisions are so largely determined either by economics or technology that the scope for lay judgments is relatively small.

What is true of Ministerial directions is still more true of Parliamentary control since the individual M.P. is likely to be less fully seized of the data and considerations upon which the various decisions have to be made. The private Member may have a feeling that the investment in one of the nationalised industries is running too high (or too low), he may have a " hunch " that less should be spent on hydro stations and more on nuclear ones. He may even be right, although he labours under the severe handicap that most of the information on which the decision must rest can only come from the Boards themselves. In any case the correct decision is unlikely to arise as the result of Parliamentary encounter.

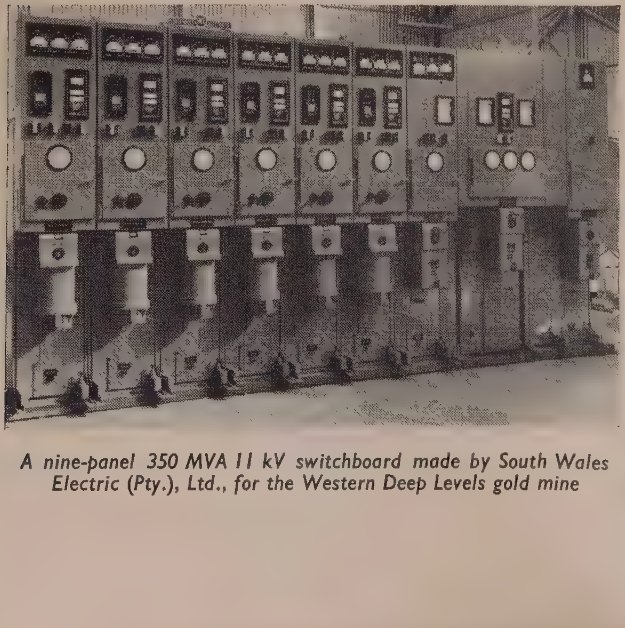
A periodical debate on the nationalised industries is all to the good. It helps to keep the industries " on their toes," gives an opportunity for grievances to be aired and for new or unconventional suggestions to be publicised, and for the decisions that have been made to be criticised or justified. But it would be quite unrealistic to suppose that such a debate could make much positive contribution to the efficient conduct of the electricity industry. So many of the decisions therein depend on a shifting balance of technical and economic factors which are quite inappropriate to the cut and thrust of a partisan debate and are more likely to be helped by the slide-rule than the Speaker's Mace.

Even those in charge of the industry are not entirely free agents but are to a considerable extent the slaves of its inherent characteristics. The two central facts of the electricity supply industry are its persistent and substantial rate of growth and its dependence on rapidly changing scientific discovery and technological developments. Together these two features call the tune, and both the Boards and the Government have to dance to it.

ACTIVITIES IN AFRICA

SOME views on conditions facing British electrical manufacturers in South Africa have been expressed by Mr. C. L. de Beer, M.I.E.E., M.I.(S.A.)E., managing director of South Wales Electric (Pty.), Ltd., the Johannesburg subsidiary of South Wales Switchgear, Ltd., upon a visit to this country.

Mr. de Beer said that in some ways South Africa was more technologically minded than Great Britain. " It has to be so if firms are to succeed, because competition there is much fiercer, with more firms competing for fewer customers in a compressed market." They were very proud of the progress they had made with South Wales Switchgear products and particularly proud of the fact that they had never lost a customer and that most of their contracts had been followed by repeat orders.



A nine-panel 350 MVA 11 kV switchboard made by South Wales Electric (Pty.), Ltd., for the Western Deep Levels gold mine

As regarded the technological approach to switchgear problems in South Africa, Mr. de Beer said that one great advantage lay in the fact that the technical staffs of the firm's customers in Africa were made up of engineers trained in Great Britain, America and Germany. The interchange of ideas and methods thus available had given them an unrivalled knowledge of switchgear problems and this had led to improvements in design.

The manufacture of transformers was begun in Port Elizabeth by the associated concern Aberdare Electric Africa, Ltd., in 1951, and in 1956 South Wales Electric (Pty.), Ltd., was established in Johannesburg for the purpose of extending South Wales Switchgear's exports to South Africa and also for partly manufacturing switchboards locally; it has recently built a 250 kVA 6·6 kV power station auxiliary switchboard and a 350 MVA 11 kV board for controlling the 30 MW pumping supply for the Western Deep Levels gold mine. The Port Elizabeth factory is now making three 10 MVA transformers for the local electricity supply authority. The parent company has in addition established a small factory in Salisbury, Southern Rhodesia, to cater for local transformer and switchgear needs.

Mr. de Beer was born in Cape Town and had training both there and in Great Britain with Metropolitan-Vickers and Henley's. He was the founder of Cooper & de Beer (Pty.), Ltd., and is still chairman of that company.

VIEWS on the NEWS

By "REFLECTOR"

ELECTRICITY Consultative Councils are called upon to deal with a variety of complaints and problems. At a recent meeting of the Eastern Electricity Consultative Council attention was drawn to a cracked ceiling at the home of an electricity consumer alleged to have been caused by one of the Eastern Board's electricians. The consumer expressed the opinion that the damage arose from the circumstance that only one man was engaged on the job instead of an electrician and a mate. He had had to move about above the ceiling much more than two men would have done. This seems to be a queer piece of reasoning. I should have thought that two men would between them have moved around much more, quite apart from the extra weight they would represent. Anyhow the consumer should not have to pay so much for the job.

* * *

Last year the hard core of the Post Office's waiting list for telephones was reduced by 11,000 to the "lowest figure since the war." Lack of cables or exchange equipment are given as the reason why the remaining 49,000 continued to be unsatisfied. The Post Office annual report implies that insufficient allocation of funds by the Treasury was largely to blame and certainly the manufacturers have made it plain that there is no lack of production facilities. I am sure they would like to step up their deliveries of equipment. On the credit side the report points out that the number of telephones in service rose by 324,000 and that 40 per cent of all applications were connected "by the end of the following month." But the Post Office clearly has far to go before it is selling telephones rather than explaining why they cannot be provided. The telephone service is a remunerative side of the Post Office business but the Postmaster General last week hinted at possible increases in Post Office charges including, presumably, those for telephone service. Higher costs would be accepted more readily if the service were swifter and better: if, for instance, the conversion of manual to automation operation were speeded up.

* * *

There was a time when the principal argument brought against electricity in the home was the alleged excessive cost. Electricity prices have been increased so little in comparison with other agents that this argument seems to have lost what validity it may once have had. Somebody asked a writer in the *Sheffield Telegraph* recently whether there were any hidden snags in an all-electric house which the questioner was contemplating. The answer was that there were no snags but that in some parts of the country there was a voltage drop at peak periods which made the supply inadequate for its duties. The inquirer was advised to consult his Electricity Board to make sure that there were no supply problems at the present time. It will be a pity if overloaded distribution systems prove a handicap to development when the cost bogey has been laid.

* * *

Apart from the coal stocks which the National Coal Board finds it difficult to dispose of there is another surface reserve in derelict coal tips. While this is ordinarily unsaleable and unusable, it is apparently grist for the pulverising mills of the Central Electricity Generating Board. There appears to be millions of tons of coal and dust lying around in this way and generally it can be acquired by the Board for the mere cost of carting it away. There is a tip at Speedwell, near Bristol, which originally consisted of about a million tons. From this 200,000 tons has been reclaimed and it is estimated that the Board has saved £275,000 in the past two years by using it. There are similar usable deposits in Wales, the Midlands and the North of England.

* * *

In a note on Mr. Ellis Smith, who has just celebrated the twenty-fifth anniversary of his election to the House of Commons, *The Guardian* says:—

> "When he first left his job as pattern maker at Metrovicks in Trafford Park to fight the seat at Stoke-on-Trent South he was not at all certain of winning . . . he left his tools behind on the bench, thinking he would soon be back. Though it has become increasingly clear since that his place at Westminster is quite secure, the tools are preserved just in case."

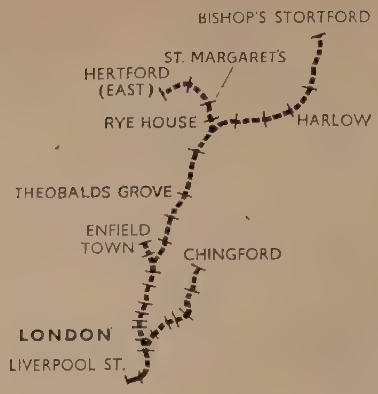
After so long an absence Mr. Smith would surely need a rehabilitation course.

* * *

In the *Electrical Review* of 28th November, 1890, I have come across the following quotation from a weekly journal of that period:

> "Count Mattei, the famous Italian cancer curer, is now over two-and-eighty, but looks three decades younger, and, though he has lived for many years alone on the hills near Bologna, his manners are those of a polished man of the world. He says he owes his rugged health to the use of his famous electric globules, which he takes daily in his coffee, and which give the taker an imperceptible electric shock—the principle and secret that distinguish his medicines from homœopathy. He tells many stories of miraculous cures he has effected by the aid of his 'blue electricity,' and says that he owes its discovery to a mangy dog, which every day ate at the same plant in the wood. . . . By trying a decoction of the plant used by the dog, he was able to cure skin diseases. His great secret lies in the fixing of electricity in these decoctions."

N.E. London Electrification



A doubling of receipts in a few years is expected from the services introduced this week on the newly electrified suburban lines from Liverpool Street to Bishop's Stortford, Enfield Town, Chingford and Hertford East

This latest suburban electrification scheme of British Railways serves a growing dormitory area which already contains nearly a million people. In all, 45 route miles (111 track miles) have been electrified employing the standard 25 kV 50 c/s a.c. system with overhead conductors. The full voltage is used on the outer sections (beyond Cheshunt) but on account of clearance difficulties the voltage is reduced to 6·25 kV in the built-up areas approaching Liverpool Street.

Work started in the autumn of 1957. The civil engineering work has involved the reintroduction of the Southbury Line, which had not been used for passenger traffic for many years; the building of two completely new stations at Harlow Town and Broxbourne; the modernisation of buildings at several other stations; the construction of four new signal boxes and of track sectioning cabins; and the construction of carriage cleaning sidings at Enfield Town, Chingford and Hertford East. Of the 80 bridges on the N.E. London lines, some 30 had to be reconstructed and another 14 raised; seven new concrete footbridges, of a new design, and three station bridges were also built. Permanent way work included the lowering of track at 12 bridges and through four tunnels.

Multiple-Unit Stock

The services, to greatly improved timetables, are provided by 71 multiple-unit train sets built in British Railways' own workshops and fitted with electrical equipment supplied by the General Electric Co., Ltd. The 52 three-car sets (battery driving trailer, motor coach, and driving trailer) will be used on the densely-populated Enfield Town and Chingford lines; and the 19 four-car sets, which have an additional trailer composite coach, will be used for the outer suburban services to Hertford East and Bishop's Stortford. All the trains have single-anode liquid-cooled excitron rectifiers; low-voltage tapping by cam-operated switches and independent rupturing switches; single-phase induction auxiliary motors except for the compressors which have d.c. motors; and an auxiliary d.c. supply by rectifier and static voltage regulator. The 200 h.p. traction motors operate at 687 V. This electrical equipment was more fully described in the *Electrical Review*, 7th October, 1960.

Power supplies for traction purposes are obtained from the Electricity Boards' networks and fed into five feeder stations. If a feeder station is out of operation arrangements can be made for through feeding from an adjacent station.

The three 6·25 kV track-sectioning cabins associated with neutral sections have two section switchboards with normally-open bus-section switches; the other five 6·25 kV cabins have single section cabins; and there are two 25 kV cabins with single section switchboards. The voltage changeover neutral section is at Cheshunt and both 25 kV and 6·25 kV switchboards are installed in the track sectioning cabin there, together with a 3 MVA 25/6·25 kV transformer for through feeding.

Outgoing track feeder circuit-breakers are generally fitted with distance impedance protection, set to trip on forward current only, with thermal protection as a safeguard against persistent faults of a magnitude similar to peak traction loading. Where a circuit-breaker is used to parallel two tracks, it is fitted with simple overcurrent and thermal protection. Incoming feeder circuit-breakers are fitted with overcurrent protection which forms a back-up for the distance impedance protection.

An automatic reclosing feature is provided on all track feeder circuit-breakers. For 25 kV, the reclosing time interval is adjustable between 2 and 10 sec, and for 6·25 kV it can be varied between 10 and 120 sec.

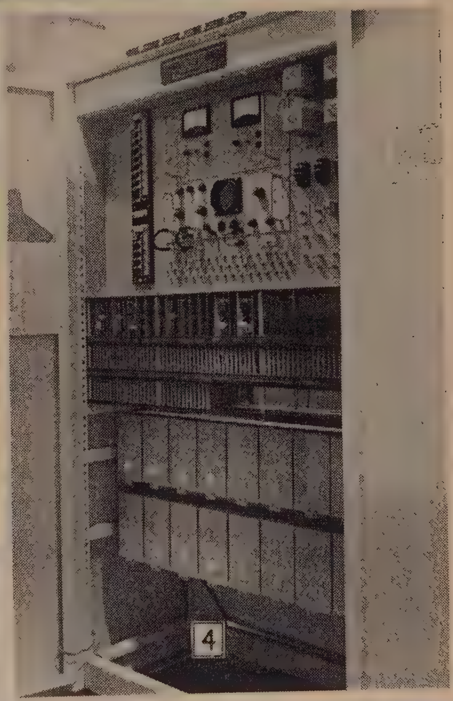
Remote supervisory control and indication facilities for all circuit-breakers and motorised overhead line switches are provided at the new electrical control room at Romford, which also controls the electrified line from Liverpool Street to Southend.

The overhead line equipment, which was supplied and installed by British Insulated Callender's Cables, Ltd., is of simple and stitched catenary construction. Overhead spans and neutral sections are at convenient points along the line, which is thus sectioned electrically, not only at the feeder stations and track sectioning cabins, but also by switches at certain strategically placed overlap spans.

A system of return conductors and booster transformers has been installed with the object of avoiding interference to signalling and telecommunications circuits.

The neutral sections, which are necessary where there is a change of voltage or source of supply, comprise an arrangement of four gaps formed by parallel conductors or section insulators in the overhead lines so that locomotives or multiple-unit trains with varying pantograph spacings will not bridge two sections of different phase or voltage. On approaching the voltage changeover section, the pantograph is disconnected by means of permanent magnets in the track which open the air circuit-breaker on the roof.

Power supplies for signalling are taken from local sources at 12 places at 650 V single-phase 50 c/s. Should the normal supply fail, a standby supply is automatically derived from the traction system. Colour-light signalling



1. A train leaving the new station at Broxbourne and Hoddesdon for Bishop's Stortford, with the new signal box on the left. 2. The changeover section 6·25 kV to 25 kV at Cheshunt. 3. Side view of coach showing undercar mounting of rectifier case and tap changer. 4. A "Westronic" electronic interlocking control cubicle. 5. Rye House feeder station. 6. The electrical control room at Romford is provided throughout. The d.c. track circuits are limited to 200 yd in the 6·25 kV areas and 500 yd when the traction voltage is 25 kV. The point machines are of the combined type and operate at 110 V a.c., with a d.c. controlling relay for closing.

The panel in Hackney Downs signal box was the first of its kind in the Eastern Region. It operates on the route system, using push-buttons for all route-setting operations. In order to set a route the signalman depresses a button associated with the signal which it is desired to clear. A light in this button commences to flash and continues to do so until the next button along the selected route is also depressed. Providing that interlocking conditions are suitable, the light in the entrance button is now continuously illuminated and the white route lights between the two buttons light up. Any points associated with the route are set in the correct position and when detection has been obtained, the signal clears. The signal indication consists of a normally red light adjacent to the push-button. Through an arrangement of internal filters this light changes to green as soon as the signal clears to any aspect. As the train passes along the route, the route lights associated with each track circuit in turn change from white to magenta during the period that any particular track circuit is occupied. Thus, after the train has passed, the indications on the panel are the same as before, except that the signal indication is now showing red.

The " Westronic " equipment is contained in cubicles at both Hackney Downs and Clapton Junction. Only one pair of wires is required between Hackney Downs and Clapton to control all the routes at Clapton and to repeat all the Clapton indications on the Hackney Downs panel. An instruction or indication passed over the " Westronic " equipment results in the operation of a relay, from the contacts of which a circuit is taken to either the interlocking at Clapton or the indications on the panel at Hackney Downs. An oscilloscope is built into each of the terminal equipments so that routine checking of the circuits can readily be carried out.

Cancellations and failures of signalling and brake equipment disrupted the working on the first day of the new services last Monday. In view of the more intense timetable and the operation staffs' lack of familiarity with the new equipment, some initial difficulties were expected, but it was thought that they would be overcome within a few days.

Letters to the Editor

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Ampères or Kilowatts?

SURELY the reason for rating plugs and sockets in ampères (" Views on the News," 7th October) is that it is the current which causes heating of the cables which the fuses are meant to protect. It is possible though, I admit, not very likely in the domestic installation, that a purely reactive load could be connected. Could this then be rated in kilowatts?

A much more logical suggestion, as I see it, would be that there should be an indication on the rating plate of each appliance of the maximum current it should be expected to take. The appropriate plug or fuse would then be much more easily selected.

Shrivenham, Wilts. J. R. EDWARDS.

Railway Modernisation

THE remark by " Reflector " (4th November) that the British Transport Commission can safely go ahead with its schemes is very questionable at the present time. Until the B.T.C. can show that it is capable of economically utilising its existing assets I would suggest that further capital expenditure is most undesirable.

British Railways are now committed to 25 kV a.c. for most new electrification schemes despite the doubtful advantages of this system. (Can it really be agreed that it is sensible to convert the 1,500 V d.c. lines out of Liverpool Street in order to extend a basically suburban network?) This system is responsible for some of the large-scale civil engineering work which is causing so much irritation to travellers. But such schemes as station rebuilding and track re-alignment could well wait upon the completion of a fairly large electrification project and subsequent worthwhile results before embarking upon unessential expenditure.

After expending huge sums of money British Railways are unable to show any real improvement; in many instances standards are below pre-war. The utilisation of much equipment is hopelessly uneconomical: it is possible for instance to observe two or three locomotive changes on a journey from Newcastle to Bristol or the double heading of trains by diesel locos where previously successful operation by single steam locomotives was taking place.

Until there is a very drastic awakening by British Railways I am forced to the conclusion that many of the Railway Conversion League's observations are perfectly valid. The overall efficiency of operation is low compared with road transport. Rail charges and fares are often very much in excess of those for road transport, yet every year there is an ever-mounting loss. The proposed increases in ordinary fares threaten to place rail travel beyond the means of private persons to the extent that the retention of passenger facilities is questionable.

Sheffield. M. W. BURNBY.

KITCHEN APPLIANCES

In our series of illustrated surveys of domestic electrical equipment, next week's issue will contain a detachable supplement dealing with four of the smaller kitchen appliances—food mixers, kettles, coffee percolators and toasters. The tabulated information will include special features of each appliance, price, and the name and address of the maker or distributor

Radio in the Supply Industry

By **R. E. MARTIN,** D.F.H., M.I.E.E.*

Summary of a paper by E. H. Cox, M.I.E.E., and R. E. Martin, D.F.H., M.I.E.E., entitled "Radio Communication in the Power Industry," which was read before a meeting of the Supply Section of the Institution of Electrical Engineers on 16th November

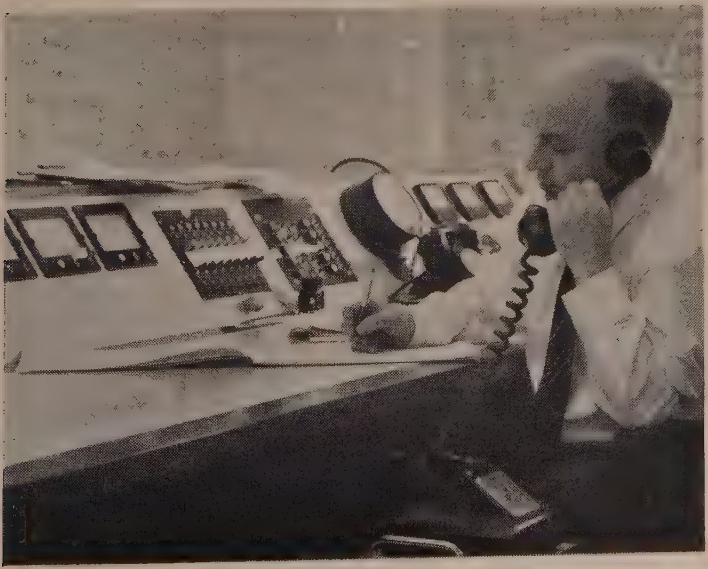
THE many aspects of the operation of any large production and distribution industry each require a variety of telecommunication facilities. The electricity supply industry needs comprehensive telecommunications and the provision of the requisite remote control, telemetering and allied equipment has engaged the attention of specialists for many years. Voice telecommunications play only a small part amongst the many aspects in which the electronic and telecommunication engineers can apply their techniques.

In the past the channels of communication for these "teleoperation" services in Britain have been rented cable circuits and will probably remain so to a large degree. Power line carrier is employed to some extent and with improvements in the techniques its use is likely to grow.

Radio communication is being employed to an increasing extent for man-to-man telephonic communications, particularly where mobile service is required. It is also beginning to be employed by power engineers for "teleoperations" where by reason of reliability, flexibility or economics, advantages exist over other methods.

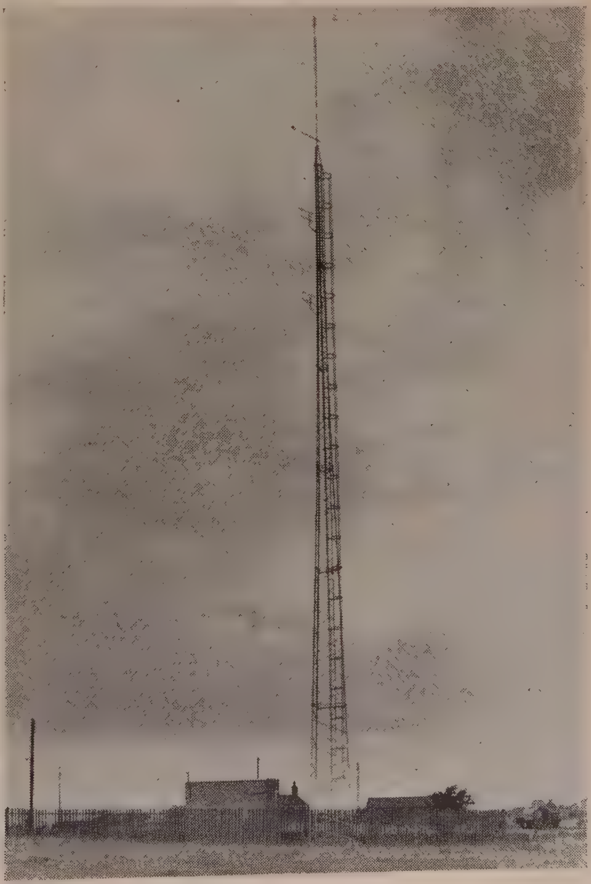
Mobile radio telephony is now widely used in the electricity supply industry, particularly for the co-ordination of engineering work on the transmission and distribution networks. It is also being largely used for commercial "consumer service" communications. In July, 1960, there were 3,244 mobile stations and 246 base stations operating on 132 licences in the electricity industry of the United Kingdom.

Right: A typical v.h.f. base station. Below: An Electricity Board control room



Many of the problems arising from the widespread use of mobile services have been solved, often as a result of experience. It is likely that the increase in the use of mobile radio will continue as new uses are found and as equipment becomes smaller and lighter enabling fuller use to be made of the improved coverage from base stations.

The need for careful forward planning of frequency allocations in relation to the organisation of the whole industry, its geographic and administrative boundaries, is emphasised. Close co-operation with the gas and coal industries has enabled specific frequency requirements to be forecast and has assisted in enabling sharing of frequencies and in the reduction of mutual interference. The industries have been active in studying the application of radio to "teleoperations" by users in similar industries overseas. They have been active in stimulating the development by industry of special equipment for remote indication and control using the latest electronic



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* Central Electricity Research Laboratories, Leatherhead.

techniques and suitable for use either over line wires or radio circuits.

Fixed v.h.f. radio links have not been employed to a great extent owing to the necessity for conservation of frequencies for mobile working. However, the development of economic u.h.f. and microwave systems specifically engineered for power system application with the possible requirement for telemetering and protection systems using high-speed digital data transmission will probably change the picture.

DISCUSSION

Mr. G. F. Peirson (Midlands Electricity Board), referring to the improved service to consumers which the use of v.h.f. radio made possible, recalled an occasion on which a lady, returning from a call box 200 yards from her home from which she had telephoned to say that her cooker had broken down, found the van already outside her door. Dealing with fixed schemes, he mentioned that his Board had a phase-comparison line protection system on a 14 mile 33 kV line, the radio link being in the 1–2 Mc/s band. After testing, it had been put into commission over a year ago, since when it had given six correct, but no incorrect, operations.

The use of radio for substation control would grow in importance and would improve the quality of supply particularly in remote areas. Instead of having to wait for a consumer to complain that he had no supply, the remote substation would immediately indicate at the control centre the circuit or circuits affected and the control engineer could take remedial measures forthwith, even to the extent of operating circuit-breakers by radio in the station affected or others which were radio-controlled.

Mr. T. T. Bell (G.E.C.) commented on the wide discrepancy between the importance of the services and the tight price limits imposed. The difference in price category between equipment used for less important services and that for the control of large amounts of power might be in the ratio of 2/1. For standby power supply for essential radio schemes he suggested a transistorized supply rather than a rotary generator to obtain immediate change-over, which was very important when point-to-point links were used for digital data transmission. He also suggested that consideration should be given to going below the 25 kc/s bandwidth and mentioned that work was being done on 12½ kc/s systems.

Mr. J. Brinkley (Pye Telecommunications) said that the development of mobile radio for the supply industry had been characterised by good planning, orderly use of frequencies and a strong pioneering spirit. The manufacturer of mobile radio equipment was very concerned with reliability; in many cases, he had a large investment in the renting of equipment and the cost of replacement of parts was of great importance to him. The difficulty was that often there was only a limited choice of components. His firm had collected statistics on the fault liability of mobiles for some years and found that the average figure was four faults per mobile per annum, of which 30 per cent were due to valves. The greater part of the unreliability was due to the components. While great progress had been made by the electricity authorities with mobile radio, on fixed services it had been very slow indeed, which was depressing when compared with the vast use of fixed-point radio in America and Japan.

Mr. J. Pierson (Elliott Bros.) referred to the use of u.h.f. for mobiles and said that in general the range seemed to be less than with v.h.f. and the fades deeper and sharper. With careful siting of the transmitter, however, u.h.f. might be useful for local schemes, particularly in built-up areas where there was enough reflection off buildings to make it possible to get round corners, and for fixed links it would have advantages.

Mr. E. H. Cox, on the suggested use of 12½ kc/s, said that at present this was new and untried, and even 25 kc/s was very much in its early stages. It would be incongruous for some organisations to be forced to use such a narrow bandwidth while others were still using 100 kc/s. On the question of the use of amplitude or frequency modulation, to which several speakers had referred, he said it had been felt that amplitude modulation was more robust, easier to maintain and gave the area required, but the time might have come to look into the question again. On the use of transistorised standby power, one of the problems was to get an invertor with a good clean sine wave and with an efficiency of 80 per cent at 50 c/s.

Mr. S. W. Dillow (C.E.G.B.) remarked that unfortunately power stations required a great deal of water, and this often led to their being situated in valleys, so that to get u.h.f. out of the valley there must be a repeater station on the nearest hill-top, which detracted from reliability; or else the station was on an estuary, where there was trouble from fade over water. To this Mr. R. E. Martin replied that in America and Switzerland power stations were often in deep valleys, but microwaves were used extensively with a transmitter on the top of a nearby hill.

Mr. F. W. Gee (Ferranti) suggested that if the relationship between quality and price could be established—and he saw no reason why it should not be—it would be a matter of arithmetic and not of opinion to choose the right equipment, so avoiding the waste of money by buying equipment which was better than was necessary and the loss of money by buying equipment which was not good enough.

Problems in Mountainous Areas

Mr. A. J. Davidson (North of Scotland H.E. Board) found it difficult to agree with the authors' comments on the general use of "talk-through" with reverse frequency trigger schemes and suggested that they had not had due regard to the difficulty sometimes experienced in multi-carrier working. In mountainous territory, multi-carrier working might be the only way of getting the necessary coverage from a central control point. The use of u.h.f. or, where this was not possible, v.h.f. links between the control centre and fixed stations should be the normal method of operating and would overcome a very difficult problem met with in the use of three-station diversity schemes on reverse frequency trigger. Under adverse weather conditions, when large electrically-charged clouds remained near a station in a mountainous location for some time, noise resulting from the static charges induced in the aerial was transmitted back to control, resulting in the shutting down of the whole network. With radio link control, the control station receiver of the offending link could be switched out, leaving the rest of the network in service.

A recent development of link operation was the combined use of directional links for incoming traffic from the remote base station and the reverse frequency technique for outgoing traffic from control. It was thus possible to reduce the number of additional link frequencies required to three, while effecting a substantial saving in the link equipment.

Mr. G. S. Buckingham (M.E.B.) said that what disgruntled the supply industry was that when it gave up a 100 c/s channel it got only two 25 c/s channels back and they were not so good as the original. He felt that the authors would like to be given a nice big slice out of the spectrum, say 1,000 c/s, which they could divide up as they liked. The best advertisement that the supply industry could have was continuity and security of supply, and that had been vastly improved by the use of radio.

INDUSTRIAL NEWS

E.T.U. ELECTION APPLICATION

IN the Chancery Division on 18th November Mr. Justice Buckley heard a motion by Mr. Leslie Arthur Tuck, a member of the Electrical Trades Union, asking for an order to restrain Mr. F. Foulkes, the general president of the union, Mr. F. Haxell, the general secretary, and Mr. R. McLennan, the assistant secretary, from proceeding with arrangements for holding an election for delegates to the 1961 Rules Revision Conference of the union and from publishing the names of persons purporting to have been validly nominated as candidates.

It was explained by Mr. Tuck's counsel that the application related to an action in which the plaintiff claimed a declaration that the election now being held by the defendants for delegates to the Conference had not been conducted in accordance with the rules of the union; that this also applied to the grouping of the union's branches into electoral divisions; that the election was void; that a fresh election should be held; and an injunction in the terms of the motion.

After dealing with the proposals for the grouping of the branches, which he said were not likely to be published before the election had been completed, counsel said that there had been delay in sending out the nomination papers which was unfair to certain candidates.

Counsel for the defendants read an affirmation by Mr. Haxell that under the rules the last day for sending out the nomination papers was 19th August; they had actually been dispatched on 15th August. There was no provision in the rules requiring the publication of a complete list of divisions; the procedure adopted had been in use for 20 years. There was no foundation for Mr. Tuck's allegation that the defendants' object was to secure the election of a particular kind of candidate. Mr. Tuck had been nominated by his branch.

In an affidavit in reply to this, Mr. Tuck said that he had also been nominated by three other branches. He believed that the delay in publishing the grouping of branches had given Communists or their sympathisers an unfair advantage.

Mr. Justice Buckley said he thought that the nomination papers had been sent out two days late and it was not until then that the members learned of the grouping of branches for the election and a candidate could not effectively canvass. There was a *prima facie* case of infraction of the rules and this had prejudiced Mr. Tuck to some extent. Nevertheless His Lordship did not think it proper to prevent the union from proceeding with the election but they would do so at their own risk. If Mr. Tuck proceeded with his action and was successful it was unlikely that he would be prejudiced in any future election. He would make no order except that there should be a speedy trial of the action.

Space Research

Queens University, Belfast, has signed a contract with the United States Advanced Research Projects Agency which will provide funds for the University's Applied Mathematics Department to expand its programme of space research. A computer centre is being built and a "Deuce" computing system has been ordered from the English Electric Co., Ltd. The installation is to be completed early next year.

PROPOSED EXPORT CLUB

Opening the Federation of British Industries (Liverpool District) Export Round Table at Southport on 11th November, the chairman, Mr. R. S. Redmond, managing director of Heyes & Co., Ltd., proposed the formation of an Export Club to facilitate a continuous exchange of ideas among smaller companies. He urged representatives from Lancashire, Cheshire, North Wales and the Isle of Man to become founder members and said that Mr. F. A. Grout, secretary of the F.B.I. (Liverpool District), had agreed to become secretary.

Representatives attending the Export Round Table have been divided into two discussion groups, one concerned with capital goods (chairman: Mr. D. White, chairman and managing director, Ashley Accessories, Ltd.), the other with consumer goods (chairman: Mr. V. Richards, managing director, Allcock Products, Ltd.).

Window Display Competition

The Rochdale Service Centre's winning window display

ENTRIES for the North Western Electricity Board's 13th annual window display competition numbered 102, the highest so far. The theme was "The Merits of Electric Cooking" and, as always in this competition, displays had to be produced on a small budget. They were first judged on a Sub-Area basis and the final Area judging was conducted by a panel which, apart from Board members and senior officers, included display specialists.

The winning window, entered by the Rochdale Service Centre and mounted by Mr. G. Ireland, senior service centre assistant, made clever use of colour and design. A blackboard drew attention to the cheapness of electric cooking and the display was surmounted by a slogan, "It's a Matter of Pounds-Shillings and Sense . . . Electric Cooking is Cheapest." Grange-over-Sands, last year's winners, were placed second with Urmston third. Other Sub-Area winners were Bury, Hyde and St. Annes.

Recent C.E.G.B. Contracts Exceed £16 Million

CONTRACTS for power stations, transmission lines and transforming stations amounting in the aggregate to approximately £16,750,000 have been placed by the Central Electricity Generating Board during the past month. They include the following:—

Blyth "B" power station, Northumberland: Control and instrumentation for Nos. 5 and 6 units.—Evershed & Vignoles. Condensing plant for Nos. 7 and 8 (350 MW) turbo-generators.—Hick Hargreaves & Co. Two 350 MW boilers.—Clarke, Chapman & Co.

Thorpe Marsh, near Doncaster: Piling for unit No. 2 and foundations for main buildings—No. 2 unit.—Holloway Bros. (London). Coal and ash handling plants, cooling water systems, earthworks and bridges for main sidings.—Mitchell Construction Co. 275 kV overhead line.—J. L. Eve Construction Co.

Elland, Yorks: Access roads and ancillary works.—M. Harrison & Co. (Leeds).

Drakelow "C," near Burton-on-Trent: Booster pumps and starting and standby boiler feed pumps for 375 MW unit, No. 11.—G. & J. Weir. Two 350 MW turbo-generators, Nos. 9 and 10, with feed heating and evaporating plant and boiler feed pumps.—English Electric Co.

Aberthaw, near Barry: 415 V switchgear and accessories for units 4, 5 and 6.—English Electric Co.

Sizewell nuclear power station, Suffolk: 200-ton dockside crane.—N. V. Machinefabriek Hensen.

Belvedere, Erith, Kent: Superstructure works.—M. J. Gleeson (Contractors).

Richborough, Kent: 450ft reinforced concrete chimney.—Tileman & Co.

Northfleet, Kent: Ash and dust handling plant.—Babcock & Wilcox.

Bankside, London: Superstructure.—Higgs & Hill.

West Thurrock, Essex: High pressure pipework and valves for Nos. 3 and 4 units.—Stewarts & Lloyds. Extension of ash and dust handling plant.—Babcock & Wilcox.

Lower Darwen substation: Two 132/33 kV, 60 MVA transformers.—Bruce Peebles & Co.

Stockport substation: One 45 MVA transformer and ancillaries.—Ferranti.

Elstree substation: Two 40 MVA synchronous condensers.—Associated Electrical Industries.

Whitson substation: 132 kV and auxiliary cables. — Pirelli-General Cable Works.

Corby-Staythorpe/Sundon: 275 kV overhead line.—Watshams.

Brinsworth substation: Access roads, bridges and earthworks.—Henry Boot & Sons.

Chessington substation: Site and foundation works—Turriff Construction Corporation.

Cross-Compound Turbo-Generators for Canada

THE first of two 300 MW turbo-generators under construction by C. A. Parsons & Co., Ltd., for use in Canada has now been completed and is in transit to site. Both machines were ordered by the Hydro-Electric Power Commission of Ontario for a new power station at Lakeview, near Toronto. Each set is of cross-compound design and will take steam at 2,350 p.s.i. and 1,000°F with reheating to 1,000°F. The h.p. line of each turbine will be coupled to a 150 MW 3,600 r.p.m. generator, whilst the l.p. line will be coupled to a second 150 MW generator running at 1,800 r.p.m. The outer casing of the high speed generator for the first machine was loaded aboard ship on 11th November. The weight of this component is 69 tons whilst the weight of the core and windings is 150 tons. The outer casing will be transhipped at Sorel, Quebec, to a lake vessel, and proceed to Toronto up the new Seaway. At Toronto, craneage is not available and the casing will be rolled ashore from the deck of the lake steamer.

Karachi Airport Lighting

A new 10,500ft runway being built at Karachi Airport, Pakistan, to take aircraft of the Boeing 707 and Douglas D.C.8 size is to be equipped with a G.E.C. airfield lighting system costing £82,500. The contract for the supply and installation of high-intensity runway, threshold and approach lights, taxiway lights, cable and switchgear has been placed with G.E.C. Overseas Services, Ltd., by Vinnell Corporation, Alhambra, U.S.A., main contractors for the new runway, under the U.S. Corps of Engineers on behalf of the Government of Pakistan. All the airfield lighting will be controlled remotely from a new control console in the tower and will be supplied by six G.E.C. constant-current regulators: two of 17·5 kW for the approach lighting, three of 15 kW for runway and threshold lights and one of 17·5 kW for taxiway lights. The new airport facilities, including airfield lighting, are scheduled to be in operation by 1st February.

420 MW of New Plant Commissioned

THREE sets with an aggregate capacity of 420 MW and four boilers totalling 3,195 klb/hr were commissioned by the Central Electricity Generating Board last month. This was the highest monthly addition so far this year. The new plant comprised a 120 MW Parsons set and 860 klb/hr Mitchell boiler at Skelton Grange "B"; a 100 MW Parsons set and 755 klb/hr Foster Wheeler boiler at Aberthaw; a 200 MW English Electric set and 1,400 klb/hr International Combustion boiler at High Marnham; and a 180 klb/hr Foster Wheeler boiler at Spondon "H."

For the fourth month in succession the rise in electricity output exceeded 15 per cent and the average rate since the beginning of the year is now 13·1 per cent, compared with 5·9 per cent in January-October, 1959.

ELECTRICITY GENERATED AND SENT OUT FOR PUBLIC SUPPLY

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Output capacity MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B. ...	4,168	61	477·6	9,604	11	9,624	9,048	26,295
North of Scotland H.E.B. ...	19	—	1·3	36	151	192	190	1,041
South of Scotland E.B.	317	4	0·6	614	18	632	596	1,763
Total for October, 1960 ...	4,504	65	479·5	10,254	180	10,448*	9,834	29,099
Corres. total for October, 1959...	3,842	94	370·6	8,866	171	9,050	8,508	27,413
Inc. or dec., per cent	+17·2	−31·1	+29·4	+15·7	+4·9	+15·4	+15·6	+6·1
Total to date (10 months), 1960	39,990	738	4,245	92,625	1,978	94,722	89,138	
Total for corres. 10 months of 1959	36,196	944	3,328	82,104	1,558	83,768	78,776	
Inc. or dec., per cent	+10·5	−21·8	+27·6	+12·8	+27·0	+13·1	+13·2	

* The total figure includes generation by other methods amounting to 14 million kWh.

The new St. Albans showroom of the Eastern Electricity Board, looking towards the main window

Electricity Showroom at St. Albans

THE Eastern Electricity Board has secured for its new St. Albans showroom a valuable corner site at what will be one of the entrances to the new Civic Centre. The main window is on the High Street frontage and by using curved non-reflecting glass a clear view is provided of the large range of appliances within the showroom. This opening-up of the whole display area to the street, rather than using the normal type of display window enclosure, has already had the desired effect of encouraging people to enter the showroom to inspect the appliances as they normally do in a department store.

Flexibility has been the keynote within the showroom. The ceiling is divided by a wooden grid into panels which can be used either for lighting or for suspended fittings. At the intersections of the grid, vertical members can be inserted to provide support for screens and display stands, and in this way the floor area can be divided in a variety of ways.

Rough wood and cane have been used extensively in the construction of fittings and for decoration and these provide a foil to the smooth mechanical precision of the appliances. Shelves for the display of small appliances, lamps and accessories are arranged around the cash counter where electricity bills are paid and an added item of interest is a reproduction of an old drawing of St. Albans. Since a large proportion of the appliances are bought on hire-purchase, a recess with tables and chairs and pleasant lighting is provided so that the various documents can be completed in comfort.

Underfloor heating is used, with a surface of hard tiles in two colours, and a portion of the heating cable has been left exposed in one of the side windows. These windows are divided by screens and curtains to form an interesting and colourful setting for various sizes of appliances, while the small rear window, finished in veneer and bronze, is specially suitable for small objects.

A MODERN BUNGALOW

In a bungalow just built by Mr. E. Ireland at Stonely, Hunts., all the circuits are protected by miniature circuit-breakers instead of fuses. The Eastern Electricity Board has built a Moffat electric cooker into the wall of the kitchen and has installed a separate counter unit with the hotplate. To heat the bungalow (area 1,900 sq ft) there is a floor warming installation with a loading of 22·34 kW.

Other electrical features include two hot water tanks with immersion heaters, garage doors which are opened and shut by an electric motor controlled by a button within the house, and 93 socket-outlets. Double-glazed windows are fitted throughout and slab fibreglass 1in thick has been laid under the base concrete over the whole area.

ENGINEERING TRAINING

THE vital need for ensuring a constant supply of young men with engineering knowledge and skill was emphasised by Mr. W. Kenneth G. Allen, chairman and joint managing director of W. H. Allen, Sons & Co., Ltd., at the annual distribution of awards to the company's pupils, students and apprentices at Bedford last week. To provide the best engineering training, good surroundings and modern equipment were essential and Mr. Allen thought that the arrangements provided by the company, and in many other industrial establishments, must be the envy of those whose training was undergone years ago.

Sir Christopher Hinton, chairman of the Central Electricity Generating Board, who made the presentations, said that his own experience in the Great Western Railway workshops at Swindon had convinced him that no engineer could be considered to be fully qualified unless he had spent some time in the shops. He regretted a modern tendency to place young men in responsible engineering posts merely on the strength of their academic accomplishments. Sir Christopher also expressed his indebtedness to the company for the William Henry Allen Prize awarded to him by the Institution of Mechanical Engineers in 1923. This had enabled him to spend three years at Trinity College, Cambridge.

Mr. J. Wooding, the company's training manager, welcomed the young men's parents present, saying incidentally that they relied on the mothers for the supply of their "raw material."

The company at the ceremony included representatives of technical education authorities, employment officers, heads of departments, and Messrs. H. N. G. Allen, D. W. M. Allen, P. C. Saltmarsh, K. Rowell and J. W. Boddy, directors of W. H. Allen.

Sir Christopher Hinton presenting the William Henry Allen Memorial Prize for the best all round student during 1960 to Mr. J. P. Griffiths

RURAL DEVELOPMENT IN WALES

SPEAKING in Cardiff on 7th November, Alderman Kinsey-Morgan, the chairman of the South Wales Electricity Consultative Council, said that the Council had approved proposals for the completion of rural electrification in Carmarthenshire, Pembrokeshire and South Cardiganshire. These proposals provided for supplies to 1,382 farms and 444 other rural premises in 42 schemes at a total estimated capital cost of £564,000. This work should be completed by the end of March, 1965. By that time it was expected that all premises except those in very isolated areas and those where supplies were not required, would have electricity. Final plans for the remaining counties in South Wales had been approved several months ago and rural development there was expected to be completed during 1963. Originally it had been anticipated that only 85 per cent of rural premises would be connected by 1968.

The completion of rural electrification would, however, depend upon the acceptance of terms for supply by prospective consumers. Due allowance for the later development was made in the terms now offered but where such development was unlikely the terms required were substantially higher. The Council had urged the Board to find some means of reducing the terms under the remainder of the rural programme, and the Board had submitted proposals under which allowances would be made of 50 per cent of the total cost of rural schemes, or of half the cost of erecting any length of overhead line in excess of 440 yd, where only a few premises in proximity to a line were to be afforded a supply. A further provision in the new arrangements was that revenue guarantees were to be restricted to £29 5s for a farm without farm buildings. For domestic premises the maximum figure would vary according to the number of rooms from £2 12s to £13 per annum. Where a farm included a farmhouse the maximum guaranteed revenue would range from £31 17s to £42 5s. All these guarantees would be required annually for a period of six years.

The Council had received details of the Board's capital expenditure programme for the year 1960-61. A total allocation of £6,300,000 had been made available to the Board, of which £3,200,000 was being devoted to the work of improving or reinforcing the electricity network and £2,600,000 to the provision of new supplies. Included in the total was £850,000 for rural electrification.

WATER AND POWER FOR SYDNEY

The Premier of New South Wales, Mr. R. H. Heffron, last month officially opened the 62·5 MVA Warragamba Dam hydro-electric project. The single-machine power station is arranged for automatic control from Sydney, 48 miles away. The reaction turbine, alternator and the step-up transformer for transmission at 132 kV were supplied by the English Electric Co., Ltd. The main purpose of the dam is to store water for supply to Sydney, the surplus water being used for generating power either for peak or base load operation.

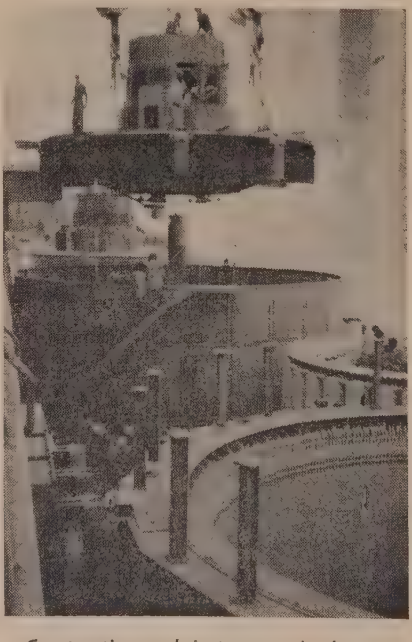
Electricity in Grenada

An agreement has been signed between the Government and Grenada Electricity Services, Ltd., for the sale to the company of the island's electricity plant and equipment. Barclays Bank D.C.O. reports that this new company is sponsored by the Colonial Development Corporation and hopes to provide an island-wide electricity service as soon as possible.

Bhakra's First Generator On Load

THE first of five A.E.I. hydro-electric generators which will supply a total of 450 MW to the Punjab and the neighbouring states, Rajasthan and Delhi, has been put on load at Bhakra, on the River Sutlej, some 200 miles north of Delhi. A second machine will begin its trials shortly and is expected to be commissioned in the New Year.

Bhakra Dam, the world's highest straight-gravity dam (740ft high and 1,700ft long) is part of the £130 million Bhakra-Nangal project, an ambitious scheme which will eventually have an installed capacity of more than 1,000 MW, as well as irrigating a large area of land. Besides the dam at Bhakra, which will store water for two power stations, another dam, at Nangal, supplies water for power stations at Ganguwal and Kotla. Both dams are part of the irrigation system. One of the Bhakra power stations is nearly finished, and delivery of the five generators has been completed. Work has started on the other power station, which is being built on the opposite bank of the river.



Construction work in progress in the turbine hall of the Bhakra hydro-electric power station. The first of the five A.E.I. generators was commissioned on 14th November

The generators ordered by the Punjab Government from A.E.I. (India), Private, Ltd., are rated at 100 MVA, 0·9 power factor, 166·7 r.p.m., and supply power at 11 kV, 3-phase, 50 c/s. Closed-circuit ventilation is provided. Protective relays, automatic voltage regulators, and neutral earthing and surge protection equipment were also supplied.

Exports of Overhead Line Materials

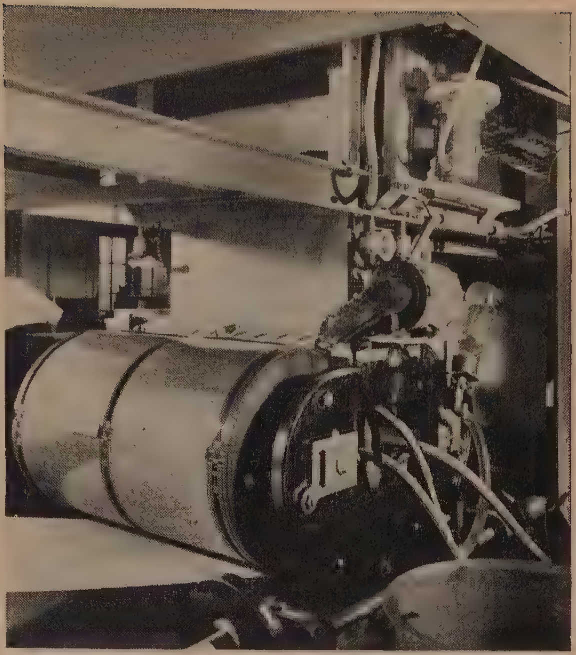
Referring to the export drive, Preformed Line Products (Great Britain), Ltd., tell us that more than 80 per cent of all the products manufactured at their Andover works are destined for overseas markets. Recent orders have included 31,000 sets of line guards for Thailand; a quantity of armour guards (diameter 0·463in) for Norway; and 34,800 sets of aluminium alloy armour rods for Pakistan, the last-mentioned order having been received through British Insulated Callender's Cables, Ltd.

Solid Dot Braille

AFTER several years of research and experiment, the Royal National Institute for the Blind has perfected a method of printing braille which uses solid p.v.c. dots. The dots are uncrushable and can be printed on thin paper, so that the new process will substantially reduce the cost of embossed volumes. The braille alphabet consists of permutations of six dots which, until now, have been embossed on special manila paper by distorting the fibres of the material to form hollow dots. The new method consists of the baking of a solid dot of plastic ink on to the surface of a thin but strong paper.

One of the problems of this process was that the p.v.c. paste used as ink has a gelling temperature near the flash point of the paper. Also, to preserve the uniformity of the dots, essential to the sense of touch, the drops of p.v.c. have to be gelled almost instantaneously. In consultation with the General Electric Co., Ltd., the problem was solved by using infra-red sheathed wire heating panels mounted horizontally one above the other to heat the paper which passes between them.

Each heating panel is 9ft long by 2ft wide and includes elements of a special shape to ensure even heating of about 200°C across the full width of the paper. The electrical loading of each panel is approximately 18 kW and is switched in sections to suit different throughput speeds. The present throughput speed is 110ft/min at which the p.v.c. braille dots are satisfactorily gelled. The paper, with its hardened paste dots, is subsequently cooled by cold air jets and static eliminated prior to fan-folding and guillotining.



The paper with the p.v.c. dots passing through the infra-red heating chamber

Transformers for the Supergrid

On 7th November a 180 MVA, 275/132 kV supergrid transformer was dispatched from the Walton-on-Thames Works of the Hackbridge & Hewittic Co., Ltd., for transport to Taunton.

FURNACE PUBLICATIONS

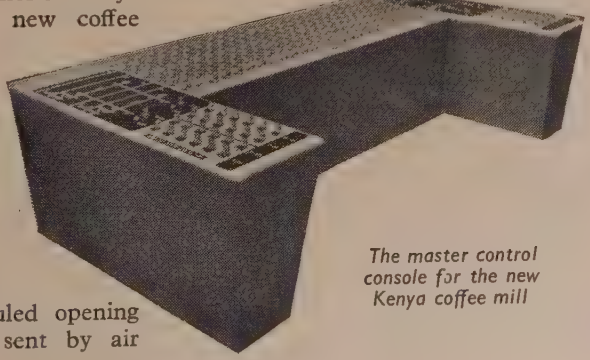
THE Engineering Group of the General Electric Co., Ltd., has produced three publications dealing with roller hearth furnaces, high temperature furnaces with hydrogen atmosphere, and induction heating furnaces. The roller hearth furnaces discussed in publication E.75 are available in a variety of forms for continuous-flow heat treatment processes. Furnaces over 400ft long and with ratings of approximately 2,000 kW have been manufactured.

For heat treatment up to 2,500°C molybdenum and tungsten heating elements are used in the range of high temperature furnaces described in publication E.78. Hydrogen is used to prevent oxidation of the elements at these elevated temperatures. Both batch and continuous molybdenum furnaces for operation up to 1,700°C are available. The use of tungsten elements is confined to small laboratory furnaces working between 1,700°C and 2,500°C.

The publication covering induction heating furnaces, E.67, describes mains-, medium-, and dual-frequency induction furnaces for heating and reheating of ferrous and non-ferrous alloys. Mains frequency is used in furnaces suitable for the through-heating of magnetic steels of 6in diameter and above, while medium frequencies from 100 to 10,000 c/s are necessary for the through-heating and hardening of steels from ½in to 6in diameter.

Control Panel for Coffee Mill

Today (Friday) the Governor of Kenya is officially opening a new coffee mill built for the Kenya Planters' Co-operative Union at a cost of £800,000. The master control console and other control desks have been manufactured by Londex, Ltd., to the order of Hartley Electromotives (E.A.), Ltd., and to meet the scheduled opening date the material was sent by air freight to Nairobi.



The master control console for the new Kenya coffee mill

COMPUTER FILM

The first film to be made by the Associated Electrical Industries film unit was shown in London last week. The "star" of the film is the A.E.I. 1010, a fast transistorised digital computer designed for both commercial and industrial application. It can work with up to a maximum of 32 peripheral machines and can also operate on five or more programmes concurrently. The 17-minute sound film is in black and white and colour, and is entitled "The A.E.I. 1010 in Industry." It is available in either 35 mm or 16 mm and can be obtained on loan from the A.E.I. film library, Central Information Department, Associated Electrical Industries, Ltd., Crown House, Aldwych, London, W.C.2.

INDUSTRIAL NEWS *[continued*

HUNTERSTON TRANSMISSION

THE transmission lines connecting Hunterston nuclear power station with the South of Scotland Electricity Board's grid system have now been completed. The first section of the new route consists of two double-circuit transmission lines running parallel for eight miles to a point just north of Dalry where they form a junction with an existing line between Greenock and Saltcoats. From this junction, one double-circuit line continues for a further 12½ miles to Neilston substation. The lines, which were supplied and installed by British Insulated Callender's Construction Co., Ltd., are to conventional 275 kV design, although they will operate initially at 132 kV. The twin conductors are 61/·125in steel-cored aluminium of B.I.C.C. manufacture and are supported on steel lattice towers with concrete block foundations.

The two parallel double-circuit lines from Hunterston to Dalry; the Isle of Arran is in the background

Large Generator Transformers

The Transformer Division of Associated Electrical Industries, Ltd., is to build two 340 MVA generator transformers for the Central Electricity Generating Board. These are the largest generator transformers so far scheduled by the C.E.G.B. They will be installed at West Thurrock power station, where they will be connected to two A.E.I. 300 MW turbo-generator units for supply to the supergrid. The transformers will have a voltage ratio at no-load of 18·5/300 kV, delta/star connected. They will be cooled by circulating the oil through oil/water heat exchangers. Completely assembled, their overall dimensions will be 47ft by 22ft by 28ft 6in high. Each unit will weigh 280 tons, the weight being reduced to approximately 185 tons for transport.

Middle East Contract

THE B.I.C.C. group has been awarded a £300,000 order by the Government of Qatar for the supply and installation of cables for the power, control and lighting circuits for a new power station. The contract also covers the supply and installation of overhead transmission lines and underground cables which are required to develop the supply system in the Sheikdom.

The installation work is being carried out in two stages by British Insulated Callender's Construction Co., Ltd. The first includes the laying of cables to interconnect the new power station with an existing station at Doha about four miles away. At this stage, a 66 kV transmission line is also being constructed from Ras Abu Aboud to Umm Said and Wakrah, a distance of 24 miles.

The power cables consist of two 66 kV, three-core, 0·025 sq in oil-filled cables with pilot cables. The overhead lines will be 66 kV double-circuit lines having 7/·161in steel-cored aluminium conductors carried on steel lattice towers. This work has already been commenced and will be completed during the next few months.

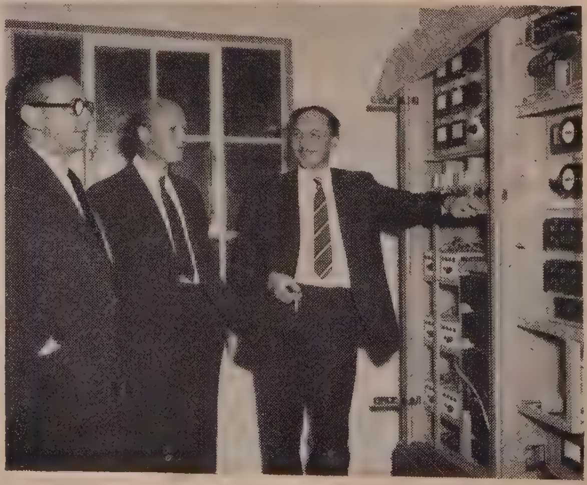
The second stage is scheduled for 1962. It provides for the supply and installation of the 11 kV power cables and control and lighting cables for the two 15 MW turbo-generator sets in the new power station at Ras Abu Aboud to operate in parallel with the existing station at Doha, which is equipped with five 3·25 MW diesel driven generating sets.

When the new station goes into operation, power will also be available for a large sea water distillation plant for the production of drinking water.

Telephone Expansion in Israel

Barclays Bank D.C.O., in a report from Jerusalem, states that the Development Loan Fund has approved a $6 million United States Government loan to help finance the expansion of Israel's telephone system.

"Pegasus" Computer for Bruce Peebles



Inspecting part of a Ferranti "Pegasus" electronic digital computer on its arrival at the works of Bruce Peebles & Co., Ltd. Left to right: Professor M. W. Humphrey Davies (Queen Mary College, London), Mr. W. Sharpley (chief of Research, Bruce Peebles) and Mr. D. McDonald (director and chief engineer, Bruce Peebles)

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Communication

Copper faced " Paxolin " is available in three standard grades—
G. Grade; a commercial quality.
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Use copper faced " Paxolin " for printed wiring in communications, control, electronic and other equipment ....SAVES SPACE—REDUCES ASSEMBLY TIME—
AIDS DIVISION OF COMPLEX CIRCUITS INTO CONVENIENT SUB-UNITS.
Other grades of copper faced "Paxolin" can be supplied if required and our engineers will be happy to discuss particular problems and offer advice.
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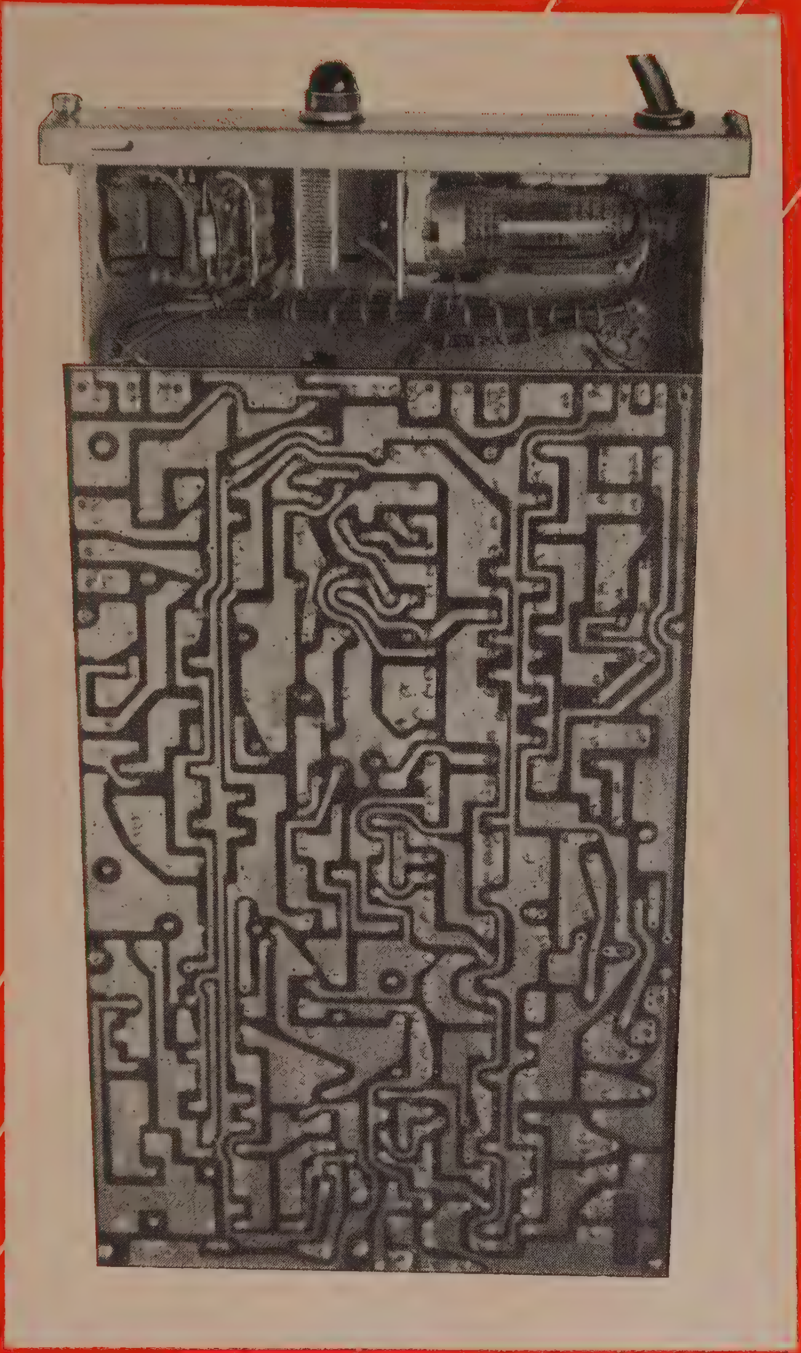

Copper-faced " Paxolin " in a transistorised carrier unit of the MC10 V.H.F. Radio Telephone Terminal. Photograph by courtesy of A.E.I. Telecommunications Division.

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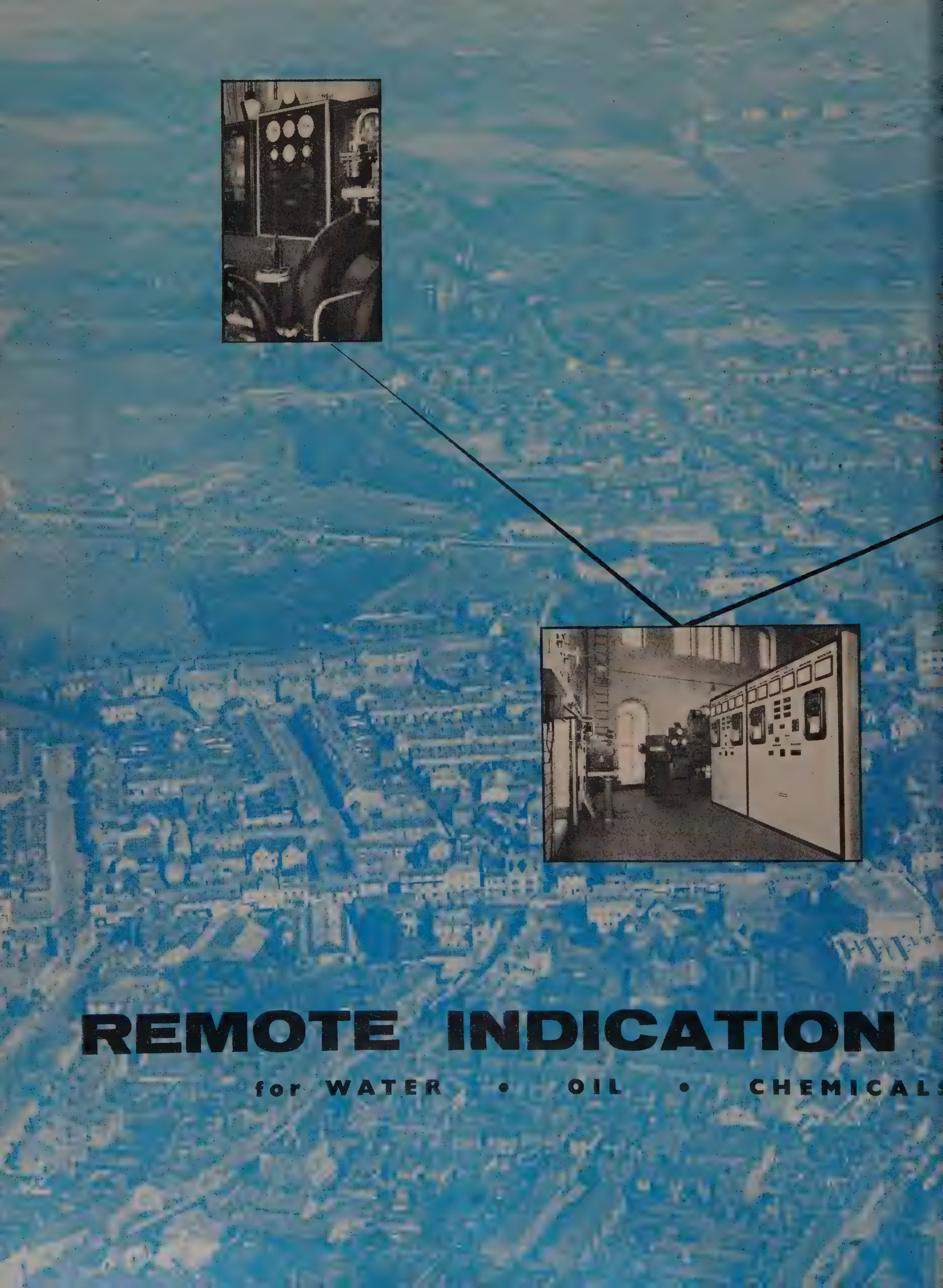
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Evershed supervisory control units enable up to 40 plant functions to be remotely controlled over two wires—with indications and alarms operating in the opposite direction over the same two wires. The system is self-monitoring and constantly checks its own synchronization. It also provides for telephone communication—*again over the same two wires.*

The illustrations show panels in use at Colchester where remote and local water reservoir levels are indicated and recorded and distant control valves and borehole pumps are operated automatically. This telemetering system makes Colchester Corporation's Water Works one of the most up-to-date in Great Britain.

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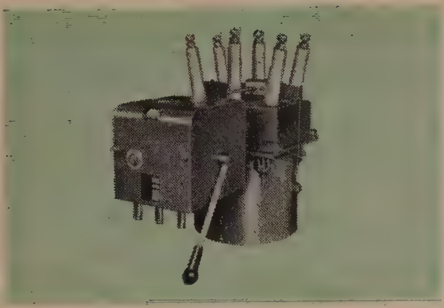
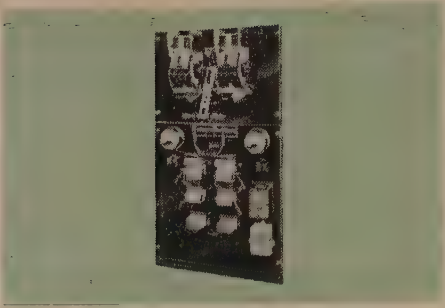
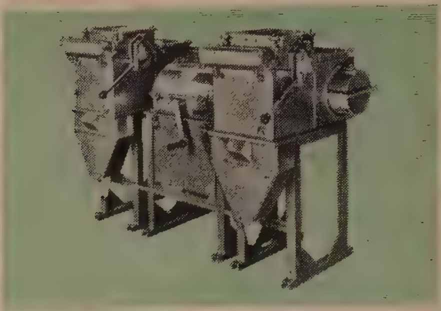


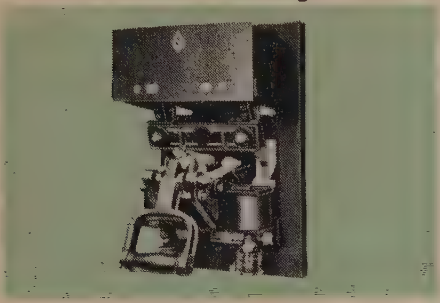
15 kV Oil Circuit Breaker for cubicle mounting



Heavy Current D.C. Circuit Breaker and Knife Switch Panel



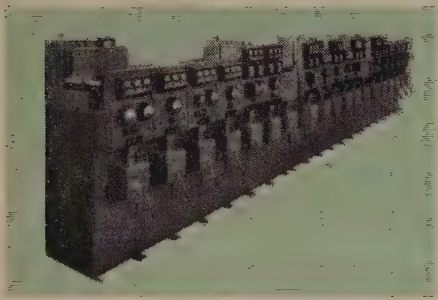
H.V. Ring Main Switchboard with Fuse Switch controlling Tee-Off



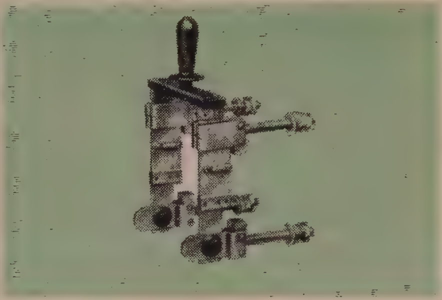
Small Air Circuit Breaker

Ammeter and Voltmeter Switches

L.V. Industrial Oil Circuit Breaker

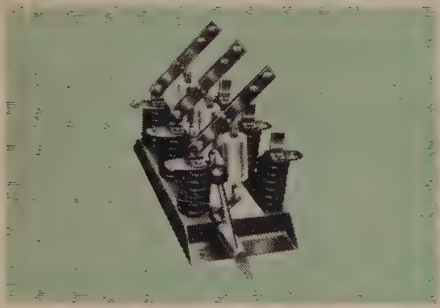


11 kV Metalclad Switchboard

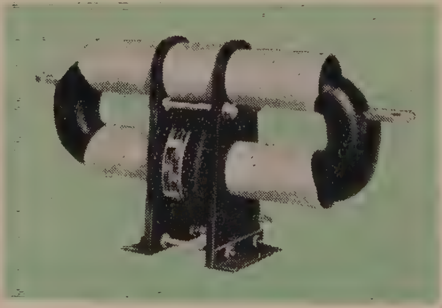


Panel Mounting Knife Switch

D.C. Switchboard for Steel Works

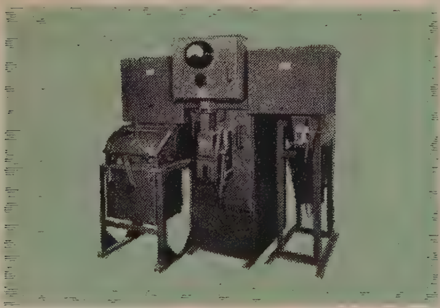


T.P. 11 kV Isolating Switch

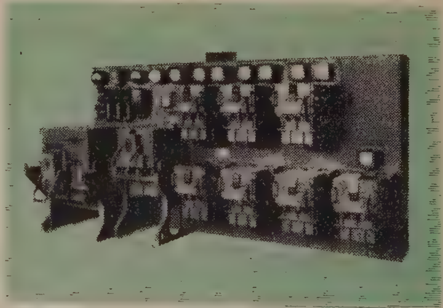


Current Transformers

Outdoor Pole Mounting Isolators



H.V. Switchboard incorporating Automatic Fuse Switch



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TRANSFORMER MANUFACTURERS' AGREEMENT HEARING BEGINS

ON Monday last the Restrictive Practices Court began hearing the reference of the Associated Transformer Manufacturers' Agreement, stated to be the minimum price fixing agreement limited to transformers sold for use in the United Kingdom, there being forty-two price restrictions, divided into categories of customers and classes of goods. The Association claim that the price restrictions are justified under paragraphs (a), (b), (d) and (f) of Section 21(1) of the Restrictive Trade Practices Act, 1956, in that, under (a), they are reasonably necessary to protect the public, under (b) their removal would deny the public, as purchasers, consumers and users, specific and substantial benefits or advantages, under (d) they are reasonably necessary to enable members to negotiate favourable terms with a person controlling a preponderate part of the market, and under (f) their removal would be likely to cause a substantial reduction in the export trade.

Mr. B. MacKenna, Q.C., Mr. Eric Walker and Mr. D. A. Grant appeared for the Association; Mr. John Megaw, Q.C., and Mr. Arthur Bagnall for the Registrar of Restrictive Trading Agreements.

Opening the case for the Association, Mr. MacKenna said that the manufacturers outside the Association made the smaller and medium sized transformers, but there was no competition between them and members in the home market in the larger transformers (above 60 MVA and 132 kV). Members had a substantial export trade and in 1959 their exports of the relevant goods were worth £8 million. There was a separate export agreement which, although the Court could not condemn it, was relevant to the contention under paragraph (f).

In outline, the defence under paragraphs (a) and (b) was that abandonment of the agreement would be likely to cause great instability in prices in the home market. There would be an immediate fall in profits, which were already at an unreasonably low level, and the effect of a further decline would be adverse to the industry's ability to develop, and to expenditure on development and research, and to expansion of the export market. Without that development, efficiency would be impaired and the industry and its customers would be the losers. In the long run prices would be higher, and quality lower, than they would otherwise have been.

As to paragraph (d), one reason why abrogation of the Agreement would lead to a fall in prices and profits was the predominating position of the Central Electricity Generating Board. It was not suggested that the Board wished to see prices fall to an unreasonable level, but where one body put contracts out to tender, and a number of manufacturers with growing excess capacity tendered for few, large, contracts, prices were bound to fall, and there was nothing the Board could do in a free market to keep prices at a reasonable level. Under this head the Association also relied on the National Coal Board, the South of Scotland Electricity Board and the Electricity Board of Northern Ireland and the Area Boards in England and Wales as preponderate buyers of various classes of goods.

The Association relied on paragraph (f) because (1) the inability to develop and maintain efficiency resulting from unreasonably low profits in the home trade would adversely affect the ability to sell transformers, particularly large transformers, abroad; and (2) the high level of the export trade depended on the working of the export agreement, which depended on the free communication of technical and other information between members, which members, if competing in price with each other at home, would be unwilling to communicate. The hearing is continuing.

Midlands Board Organisation

Long-term plans affecting parts of its organisation were announced on Tuesday by the Midlands Electricity Board. The present type and number of management levels (Board H.Q., Sub-Area and District) will be retained but the number of Sub-Areas will be reduced to six by the amalgamation of the South Staffs. and North Worcs. and Wolverhampton and District Sub-Areas. This amalgamation would be fully effective in 1963.

It is also proposed to reduce the number of Districts from thirty-six to thirty-one by amalgamating Stourbridge with Brierley Hill; Lichfield with Cannock; Stoke-on-Trent North with Stoke-on-Trent Central; Wednesbury with adjacent districts; and Leominster with Ludlow. These changes are planned for 1964 or 1965.

Contract Price Formulae

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 18th November is deemed to be 204s 6d. The "costs of materials" figures are: For electrical machinery and equipment the Board of Trade index figures published on 18th November are 180·3 (1949=100) and 116·2 (1954=100); both figures are provisional. For turbo-generating and allied plant: Materials used in mechanical engineering industries 189·4 (1949=100) and 126·1 (1954=100); both figures are provisional. Blast furnaces and iron and steel melting and rolling (1948 S.I.C. Ref. 40/41) 189·5 (1949=100) and other steel goods, excluding tubes (1958 S.I.C.), 129·1 (1954=100); both figures are provisional. The price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 18th November) is 47⅜d/lb.

ALLENS ACQUIRE GWYNNES PUMPS

W. H. Allen, Sons & Co., Ltd., Bedford, have taken over as a wholly-owned subsidiary the business of William Foster & Co., Ltd., the Lincoln engineers and boiler makers, including Foster's wholly-owned subsidiary, Gwynnes Pumps, Ltd.

Mr. W. Kenneth G. Allen, chairman of W. H. Allen, Sons & Co., has become chairman of the acquired companies, succeeding Mr. C. V. Armitage, who has resigned from the position of chairman and managing director. Mr. Norman G. Allen has also been appointed a director of William Foster & Co.

"Pocket" Power Station Switched On

The second remotely controlled gas turbine power station of the South Western Electricity Board was switched on by Sir George Hayter Hames, chairman of the Devon County Council, on Tuesday. The station, which is at Lynton, has an output of 3 MW and is remotely controlled from the Bristol control centre. The 4,250 h.p. Bristol Siddeley turbine drives an alternator manufactured by the Electric Construction Co., Ltd.

F.B.I. Register 1961

THE thirty-third edition of the "F.B.I. Register of British Manufacturers—1961" has been published for the Federation of British Industries by Kelly's Directories, Ltd., and Iliffe & Sons, Ltd. (1,162 pages, 50s post free). There is an introduction by the president of the F.B.I., Sir William McFadzean, and the Register contains lists of the products and services of nearly 8,000 member firms under more than 5,400 alphabetical headings. In addition to a Classified Buyers' Guide there are seven other sections, giving addresses of companies and firms and information about trade associations, proprietary names, trade marks, etc. French, German and Spanish glossaries, arranged for easy reference, give translations of every product term used in the main buyers' guide.

Support for North of Scotland Board

What the Council of the Highland Fund describes as "recent wanton attacks" on the North of Scotland Hydro-Electric Board are deprecated in a statement issued by the Council. The self-styled Scottish Power Investigation Committee, it states, has a membership which looks neither impartial nor unbiased. From the experience gained in the administration of the Highland Fund, the Council has found a wealth of evidence of the benefits which the Board has conferred on the Highlands. In the early days after the war, the constructional work undoubtedly prevented a much greater exodus of the Highland population than actually took place. It is also not too much to say that had the women of the Highlands not received the amenities that go with electricity, many families would have moved away from the Highlands.

The Council declares that the benefits conferred by the Hydro-Electric Board "are too many to enumerate." With the passing of time, which brings new ideas and methods, it may not be inopportune to consider if there is an alternative method of financing the distribution of electricity to outlying districts of the North Western Highlands which are still without electricity, but apart from this factor the basis on which the Board was established remains valid.

PRICE REDUCTION

Morphy-Richards (Astral), Ltd., have reduced the retail price of their A.160 "built-in" 1·6 cu ft refrigerator by £3 to £32 10s, including purchase tax.

TRADE ANNOUNCEMENTS

AS a result of the transfer of the offices of the **Telegraph Construction & Maintenance Co., Ltd.** (B.I.C.C. Group), from Mercury House, Theobald's Road, to 21, Bloomsbury Street, London, W.C.1, the telephone number and inland telegraphic address are now Museum 1600 and Telcon Phone London, respectively.

Crater Products, Ltd., have appointed the following area representatives:—Mr. E. R. F. Collier, 18, The Ridgeway, Enfield, Middx.; Mr. B. D. A. Woolley, 47, Peakhouse Road, Birmingham; and Mr. B. G. Tonge, 131, Hillfoot Road, Hunts Cross, Woolton, Liverpool.

Elliott Brothers (London), Ltd., have been appointed representatives in the British Isles for the "Airbrasive" cutting tool made by the S. S. White Industrial Division, New York. The unit cuts or abrades almost any hard, brittle material (e.g. germanium, silicon, ferrite and glass) with a controlled stream of gas-propelled abrasive.

British Insulated Callender's Cables, Ltd., has opened a new stores at 30, Tolbooth Street, Kirkcaldy (telephone: Kirkcaldy 3641).

Southern Instruments, Ltd., have introduced a scheme which enables comprehensive electronic instrumentation to be acquired on a rental basis. The equipment on hire may be purchased at any time after the first six months' rental. The scheme is operated by Southern Instruments' associated company, Instrument Rentals, Ltd.

Aero Electronics, Ltd., Gatwick Airport, have been appointed the export agents and sole distributors to United Kingdom aircraft manufacturers of **Communications (Air), Ltd.**, Bagshot, who manufacture a wide range of aeronautical electronic equipment.

Edmundsons Tools, Ltd., have opened a new branch at Craven Street, Coventry (telephone: Coventry 72381).

Geo. E. Taylor & Co. (London), Ltd., have moved to new headquarters at Turriff Building, Great West Road, Brentford, Middlesex (telephone: Isleworth 5121).

WELDING EXHIBITION

A wide range of arc welding equipment, electrodes and accessories is being shown this week at an exhibition held by the English Electric Co., Ltd., at the Kensington Court substation. Static exhibits, supplemented by welding demonstrations, included the LWAD range of welding equipment suitable for both a.c. and d.c. welding and incorporating silicon diode rectifiers, and a welding meter consisting of a watthour meter, ammeter, voltmeter and protective relay in a single case. Among the twenty-six different types of electrodes on view are the "Super Stainees" for welding stainless steel. These have a heavy coating containing metallic powder and are suitable for use with a.c. or d.c. outputs. A minimum open circuit voltage of 70 V should be employed with a.c. outputs and with d.c. a positive electrode is preferred. The exhibition is open today (Friday) from 10 a.m. to 6 p.m.

Remploy's Record Sales

The annual report of Remploy, Ltd., shows that for the first time, sales at £5,143,000 have exceeded the cost of wages paid to disabled workers, plus the cost of raw materials. "This means that we have turned a very important corner in the development of our company," says Sir Alec Zealley (chairman). "We hope that, with continued improvement in our trading, our resources will enable us to make a progressive increase in the number of disabled persons employed," he states.

The present agreement provides for employment of at least 6,000 disabled people and an annual revenue grant of £2,500,000, subject to the effects of inflation. The company's excess of expenditure over income last year amounted to £2,720,000, which is equivalent on 1956 values to £2,494,000. During the last four years the number of disabled employees has been maintained at over 6,100 and their wages have continued to rise.

New Scottish Factory

Mr. R. W. Byford, general manager of Radiation, Ltd., told a meeting of Peterhead and District Professional and Business Club on 8th November that the company was now ready to build a new factory at Peterhead for the manufacture of electric cookers and water heaters. All local formalities had been completed. Mr. J. Muirhead, one of the company's senior service engineers in Edinburgh, will be manager of the new factory which, initially, will have between 40 and 50 employees.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. J. G. Park

The North Eastern Electricity Board have appointed **Mr. J. G. Park**, M.I.E.E., M.Amer.I.E.E., as purchasing officer in succession to Mr. H. Haigh, M.I.E.E., who recently retired. Mr. Park has been the Board's organisation and methods officer since February of this year, before which he was senior operational research engineer, Eastern Electricity Board. He has twice been seconded for overseas service: in 1946 as a member of the Hydro-Electric Mission to East Africa and from 1955 to 1958 as Electrical Engineering Adviser to the Government of Ceylon.

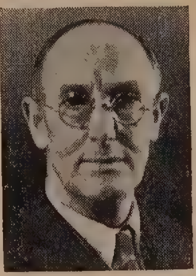
Mr. Harry West, managing director of Associated Electrical Industries (Manchester), Ltd., is to join the board of Associated Electrical Industries, Ltd., from 1st January next.

The Council of the Institute of Physics and the Physical Society has awarded the Duddell Medal to **Dr. J. B. Adams,** Director-General of C.E.R.N. (the European Organisation for Nuclear Research), for his leadership of that team; the Charles Vernon Boys Prize to **Professor A. W. Merrison,** of the University of Liverpool, for his distinguished research in experimental physics; and the Charles Chree Medal and Prize to **Dr. S. E. Forbush,** of the Carnegie Institution of Washington, for his distinguished work on cosmic radiation.

Under the terms of the scheme to commemorate the late Lord Rutherford of Nelson, the Council of the Royal Society has appointed **Mr. W. J. Darcey,** B.Sc., of Melbourne University, as Rutherford Scholar for three years, to carry out research in experimental nuclear physics at the Clarendon Laboratory, Oxford.

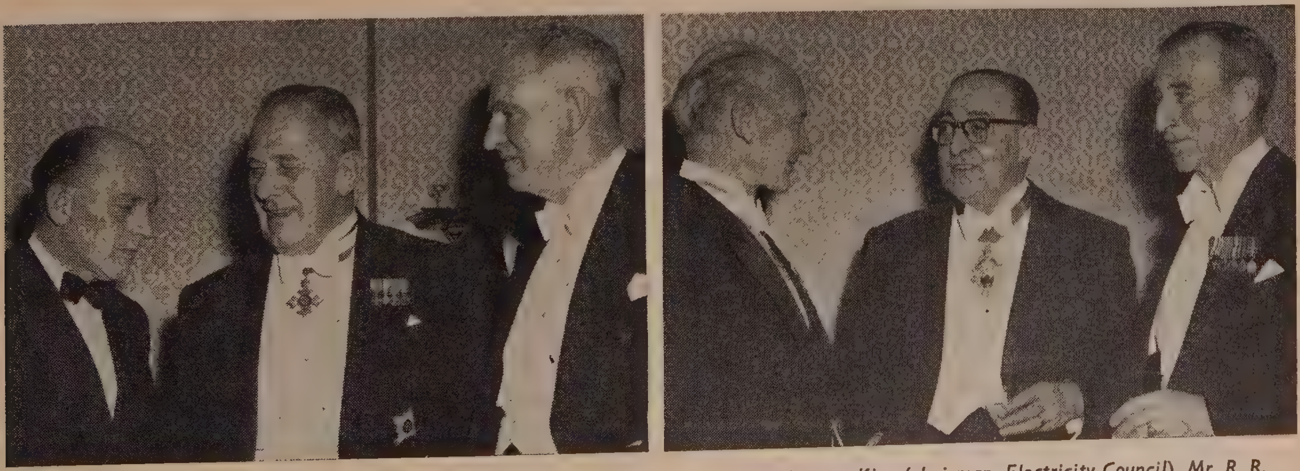
The annual dinner of the **I.E.E. East Midlands Centre** was held last week at the Victoria Station Hotel, Nottingham. Over 200 members and guests were present. The loyal toast was proposed by the Centre chairman, Lt.-Col. W. E. Gill, and the senior vice-chairman, Professor J. E. Parton, proposed the toast to the City of Nottingham. Responding, Councillor Roland E. Green, the Lord Mayor of Nottingham, referred to the impact of the electrical industry on the communal life of the country, and to railway electrification in particular.

The toast to the Institution was proposed by Mr. Niall C. Macdiarmid, managing director of the Stanton Ironworks Co., Ltd., who, in a witty speech, recalled the history of the Institution. The I.E.E. had, he said, developed in proportion to the expansion of the industry and the needs of specialist groups and he hoped that it would avoid any depression in the standards of entry to membership. The President of the Institution, Sir Hamish D. MacLaren, in reply, spoke about the recent special advisory committee report and said that the Institution would be very glad to receive any comments members would like to make. Referring to the engineering profession as a whole, he thought that some form of federation of the three senior institutions would be advantageous. They might combine in some activities, starting with public relations. The chairman of the Centre proposed the toast "Our Guests" which was replied to by Councillor R. W. Westcombe, managing director of the Beetles Building Co., Ltd.



Mr. E. Green

Mr. E. Green, M.Sc., M.I.E.E., formerly head of the Transmitter Advanced Development Group of Marconi's Wireless Telegraph Co., Ltd., and for the past six years a consulting engineer to the company, has recently retired. To mark his record of 47 years' distinguished service the engineer-in-chief, Mr. B. N. MacLarty, presented him with an inscribed gold watch and an oak filing cabinet from his many friends and colleagues. Mr. Green is an engineer and physicist who for many years has been a well-known personality in the radio engineering



Left to right: Mr. O. S. Woods (controller, East Midlands Division, C.E.G.B.), Sir Robertson King (chairman, Electricity Council), Mr. R. R. Maddock (chief project engineer, Midlands Project Group, C.E.G.B.), Sir Hamish D. MacLaren (President, I.E.E.), the Lord Mayor of Nottingham (Councillor Roland E. Green) and Lt.-Col. W. E. Gill (chairman, I.E.E. East Midlands Centre) world, having played a considerable part in the evolution of modern short-wave transmitter design. In this connection he has more than 50 patents to his credit. He is the author of a large number of technical articles and his textbook, "Amplitude-Frequency Characteristics of Ladder Networks," is a standard source of reference.

Pending the appointment of a chairman in succession to the late Sir Cecil Weir, **Mr. H. V. Stammers** has been appointed acting chairman of International Computers & Tabulators, Ltd. **Mr. C. Mead** is to be a deputy chairman and **Mr. J. Bull** managing director.

Mr. E. L. Hefferman has been appointed to succeed **Mr. R. H. Farrow** as district engineer at Hendon. Educated at Holmwood College, Bexhill-on-Sea, and the City and Guilds (Engineering) College, Mr. Hefferman received his early training with the Finchley Electricity Department. In 1930 he joined the North Metropolitan Electric Power Supply Co. and five years later transferred to the Wembley undertaking as an assistant engineer. Shortly before nationalisation he was appointed first assistant engineer at Hendon.

Mr. E. L. Hefferman

At the recent dinner of the Mersey and North Wales Centre of the Institution of Electrical Engineers (see last week's issue, page 880)—Left to right: Mr. S. Towill, Admiral Sir Michael Denny, Mr. T. A. P. Colledge, the Lord Mayor of Liverpool (Alderman J. L. Hughes), Mr. D. A. Picken, Sir Hamish MacLaren (President, I.E.E.) and Mr. W. K. Brasher (secretary, I.E.E.)

Mr. E. B. Thompson, sales manager, Ekco Electronics, Ltd., has been elected chairman of the Nucleonics Group of the Scientific Instrument Manufacturers' Association. The Electronics Section, which previously embraced the Nucleonics Group, is under the chairmanship of **Major W. Logan,** of Avo, Ltd.

The A.E.I. Lamp & Lighting Co., Ltd., has appointed **Mr. A. B. Frost** as assistant manager of its Midland Sales Region. Mr. Frost was previously assistant to the regional manager and from 1955 to 1958 the Northampton Area manager.

The Yorkshire Electricity Board has made changes in the District engineering organisation of the No. 4 (Leeds) Sub-Area. In place of the existing Leeds District, four new Districts have been established and the following initial senior appointments have been made:—Leeds North-West: District engineer, **Mr. A. R. Chell,** A.M.I.E.E., previously second assistant engineer, Construction Section, No. 4 (Leeds) Sub-Area. Leeds North-East: District engineer, **Mr. S. T. Richardson,** B.Sc.(Eng.), A.M.I.E.E., previously second assistant engineer, Leeds District (Planning). Leeds South: District engineer, **Mr. R. Jessop,** Graduate I.E.E., previously second assistant engineer, Operation and Maintenance Section, No. 4 (Leeds) Sub-Area. Leeds Morley: District engineer and local manager, **Mr. F. H. Beal,** A.M.I.E.E., previously second assistant district engineer and local manager.

The chairman of the Electricity Council, Sir Robertson King, with the recipients of British Empire Medals who were entertained at Winsley Street, London, after the presentation. The medals were presented on behalf of the Queen by the Minister of Power, Mr. Richard Wood, at a ceremony held at Lancaster House on 10th November. Front row (left to right): Mr. C. A. Green (Eastern E.B.), Sir Robertson King, Mrs. G. Stewardson, widow of Mr. G. A. Stewardson (North Western E.B.), who died in September, and Mr. W. Reeves (East Midlands E.B.). Back row: Mr. R. H. Owen (Merseyside and North Wales E.B.) and Mr. W. Cheadle (North West, Merseyside and North Wales Region of the C.E.G.B.)

Mr. P. Jardine, group financial controller, Metal Industries, Ltd., has been appointed to the boards of two M.I. subsidiaries, J. G. Statter & Co., Ltd., and Minerva Mouldings, Ltd.

New appointments to the Clean Air Council include **Mr. W. L. Mather,** chairman of Mather & Platt, Ltd.

Mr. C. H. Bailey, who joined Falk, Stadelmann & Co., Ltd., in 1890 at the age of 15, this week celebrates 70 years' service. Although he officially retired in 1951, he is still active in assisting with freight calculations and advice on import shipping matters.

Mr. C. R. Hughes, mechanical engineer in the No. 3 (South-East Durham) Area of the Durham Divisional Coal Board, has been appointed chief engineer in the area. From 1946 to 1949 he was electrical engineer with Shipley & Ilkeston Collieries, Ltd.

Mr. P. B. H. Brown, M.I.Mech.E., has been appointed chairman of Worthington-Simpson, Ltd., following the retirement of **Sir Samuel R. Beale,** K.B.E., M.I.Mech.E. Mr. Brown is also chairman and managing director of L. Sterne & Co., Ltd.

Mr. E. V. Beatson, of Joseph Lucas, Ltd., has been appointed by the Council of the British Welding Research Association to serve on the

Association's Research Board. His principal fields of interest are resistance welding and brazing.

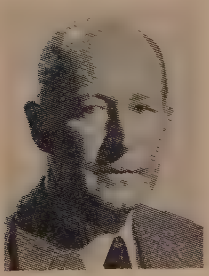
Mr. L. W. Jordan, Norfolk sub-area accountant with the Eastern Electricity Board, is to succeed **Mr. R. A. Pickup** as Northmet sub-area accountant on his retirement.

Mr. A. I. Helm has been appointed works manager of the proposed new factory of the Skefko Ball Bearing Co., Ltd., at Irvine, Ayrshire. Mr. Helm has been the company's plant engineer for nearly 25 years.

Mr. J. G. Langbridge, London and Home Counties representative of Parvalux, Ltd., has been promoted to sales manager and **Mr. G. F. Pedley** has been appointed technical sales engineer.

Mr. A. B. Skevington, acting manager of the Nottingham branch of Philips Electrical, Ltd., since September, 1959, has been appointed branch manager.

OBITUARY



The late Mr. R. M. Atkinson

Mr. R. M. Atkinson.—The death occurred on 12th November of Mr. Robert Morton Atkinson, chairman of Sulzer Bros. (London), Ltd. He was in his 71st year. Mr. Atkinson was educated at Oundle School and Sheffield University. After some 30 years with the Vickers organisation he left in 1938 to become managing director of Sulzer Bros. (London), Ltd., a position he held until his appointment as chairman in June this year. He was also a director of Richardsons, Westgarth & Co., Ltd., and their subsidiary company, George Clark (Sunderland), Ltd.

Sir John Thornycroft.—The death occurred on Monday last, at the age of eighty-eight, of Sir John Edward Thornycroft, K.B.E., chairman and governing director of John I. Thornycroft & Co., Ltd. He was the elder son of the founder, Sir John I. Thornycroft, and a past-president of the Institutions of Civil and Mechanical Engineers. His principal interests were ship construction and marine engineering and road transport.

Mr. P. L. Edwards, whose death is reported, had only recently retired from the managership of the Dublin office of Associated Electrical Industries Export, Ltd., a position he had held since 1932, and was continuing as a consultant. He was a past-president of the Society of Irish Electrical Traders.

Mr. L. M. Bowden.—The death occurred recently, at the age of 58, of Mr. Lionel Maurice Bowden, Associate I.E.E., a director of Bowden Bros., Ltd., electrical engineers, London. Mr. Bowden received his training with the Metropolitan Railway and later joined the Woking Electric Supply Co. as a shift engineer. He subsequently held appointments with Pirelli-General Cable Works, Ltd., International Combustion, Ltd., and Combustion Steam Generator, Ltd., before Bowden Bros. was formed in 1930.

Mr. T. P. W. Morris, M.B.E., M.C., deputy chairman of George Kent, Ltd., died in St. Albans City Hospital on 21st November after a motor accident.

Parliamentary Report

Higher Patent Fees

The Earl of Dundee, Minister without Portfolio, moving the second reading of the Patents and Designs (Renewals, Extensions and Fees) Bill, said it was proposed to increase the fee on application for a patent from £1 to £2 and the fee for filing a complete specification from £4 to £8. The fee of £3 on the sealing of a patent and the renewal fees which varied from £5 in the first year to £20 in the sixteenth year would remain unchanged. Only the application and filing fees were increased because nearly all the expense of the Patents Office was in connection with these two operations. It was the policy of the Government that the expenses and receipts of the Patents Office should balance. There was now a deficit of £132,000. The First Schedule of the Patents Act, 1949, which was exactly the same as the Schedule of the Patents and Designs Act, 1884, and which laid down maximum fees, would be repealed. Future changes of fees would be achieved by Statutory Instrument.

Isotope Production by C.E.G.B.

The Minister of Power (Mr. Wood), moving the second reading of the Electricity (Amendment) Bill, said its purpose was to amend the Electricity Act, 1957, to enable the Central Electricity Generating Board to produce radioactive isotopes in their nuclear power stations and to sell them. The Board's power to manufacture was at present limited to things which they or any Area Board might require for research or development or for repair or maintenance.

Trade in radioactive isotopes was steadily expanding. Five years ago the export sales were £160,000; now they were £620,000. Irradiation capacity available to the Atomic Energy Authority was approaching its limit and there were large opportunities to be seized if the Generating Board with its rapidly expanding capacity could be empowered to produce isotopes in their new reactors. With this power Britain's irradiation capacity would be comparable to any available elsewhere.

The Generating Board would carry out the irradiation of materials but the finishing processes would be the responsibility of the Atomic Energy Authority. Using the stations for irradiation purposes would not have any adverse effect on their capacity to generate electricity because the target material would merely take the place of the control rods.

The cost to the Generating Board of adapting the Bradwell and Hinckley reactors would be about £100,000 each whereas the cost of the stations themselves was roughly £50 million. He was convinced that the return on that investment would be very satisfactory.

The Parliamentary Secretary to the Ministry (Mr. George) said that 700 industrial firms were using isotopes.

The Bill was read a second time.

Illuminated Sign Competition

Details of the fourth illuminated sign design competition to be sponsored by the Electrical Sign Manufacturers' Association have been announced. Nine cash prizes will be given for the best designs for illuminated sign displays on a modern architect-designed shop in the main shopping centre of a large provincial town. The first prize will be £150, second £75 and third £40, with five consolation prizes of £10 and a further prize of £20 for the best entry by a competitor under 21 years of age.

The competition will be judged by Lord Mancroft, Sir Basil Spence and Mr. R. Nicholas, with the chairman and vice-chairman of the Association. It is open to all, and competitors may enter as many designs as they like. The last date for the receipt of entries is 31st January, 1961. Full details may be obtained from the Association at 13, Bedford Row, London, W.C.1.

Financial Section

STOCKS and SHARES

IMPLICATIONS of the bid for Ford Motor shares, and hopes of some early easement of hire-purchase terms, gave useful support to the industrial markets of the Stock Exchange during a week which otherwise produced little to stimulate fresh interest. A good many holders of Ford shares evidently decided to sell in the market on first news of the 145s offer, rather than risk the possibility of Treasury refusal to the transaction, and to reinvest the proceeds before any large part of the £129 million involved in the operation might come upon the scene. Actual or potential buying of other good equities on this account was generally agreed to have been the main factor in an all-round steadying of share prices, while gilt-edged stocks continued to be sustained also on Bank Rate considerations.

Firmer Markets

Electrical equities had their share in the improvement of prices in anticipation of official consent to the Ford deal. In English Electric and G.E.C. shares the gains were small, but A.E.I. recovered 1s to 44s 6d, while A. Reyrolle gained 3s to 38s 3d and C. A. Parsons 1s 9d to 47s 6d. B.I.C.C. were raised another 2s to 50s 6d on further consideration of Sir William McFadzean's review of cable industry prospects in the company's interim report, and Decca "A" advanced 3s 9d to 51s 3d, making a total gain of as much as 7s since Mr. E. R. Lewis's address at the company's meeting. Hoover were marked up very sharply to 49s; some analogy with the Ford Motor position was suggested. Berry's Electric at 48s 9d broke their record yet again, but most shares concerned with domestic appliances remained depressed. British Thermostat moved erratically in response to rumours of a "bid," of which the directors denied any knowledge.

Crompton Parkinson

There was a marked improvement in Crompton Parkinson 5s shares, to 11s 3d, after publication of the full report. This disclosed that a very considerable reduction in earnings from cable manufacturing cancelled out the improved results achieved by other sections of the group during 1959–60, leaving very little net change in the trading surplus. The decision nevertheless to raise the dividend by about 1½ to 12½ per cent was taken after consideration by the board of results achieved under far from easy conditions and in the belief that this year's outcome would compare satisfactorily with the latest figures. Further intensification of competition was to be expected, but the policy of diversifying the activities would help greatly to steady the trading perform-

Price Changes in

Company or Board	Nom. Value	Middle price 21st Nov.	Week's Rise or Fall	Dividend Pre-vious	Dividend Last	Yield %			1960 High-est	1960 Low-est
						£	s	d		
Gilt-edged Stocks										
Brit. Elec. 1968/73	100	74½		3	3	4	0	6	79½	74
Brit. Elec. 1974/77	100	70½		3	3	4	5	0	76	69
Brit. Elec. 1976/79	100	73		3½	3½	4	16	0	79½	72½
Brit. Elec. 1974/79	100	82		4¼	4¼	5	3	9	90½	81
Brit. Elec. 1967/69	100	91½		4½	4½	4	18	3	97½	90
Overseas Electric Supply										
Calcutta Elec.	£1	20/-		7†	7½†	12	4	0	21/-	19/3
East African Power	£1	14/9	+3d	8	10	13	11	3	20/3	14/6
Nigerian Elec.	£1	16/3		8	10	12	6	3	19/9	15/6
Perak Hydro-Elec.	£1	18/-	+3d	10	10	11	2	3	21/-	15/3
Electrical Shares										
Aberdare Holdings	5/-	15/-		17½	17½	5	18	9	19/-	14/6
Aerialite	1/-	6/3	−3d	54	54	8	12	6	9/6	6/3
Allen, W. H.	£1	40/-	+6d	12	14	4	13	3*	43/9	34/6
Allied Insulators	5/-	10/-		—	20	5	0	0*	11/6	9/9
Anglo-Portuguese Tel.	£1	24/3	+1/-	9	9	7	8	6	29/-	22/6
Arcolectric	1/-	4/6		—	15	3	6	9	5/6	4/-
Aron Meters	£1	71/6	−2/6	15	15	4	4	0	90/-	47/-
Assoc. Elec. Ind. Ord.	£1	44/6	+1/-	15	15	6	14	9	66/6	42/6
Automatic Tel. & El.	5/-	15/9		17	17	5	8	0	21/9	15/3
Babcock & Wilcox	£1	34/6		13	9	5	4	3	48/9	33/3
Bakelite	10/-	46/6	+3d	15	17½	3	2	6*	52/-	33/6
Baldwin, H. J.	2/-	2/-	−3d	20	—		—		2/6	1/9
Berry's Electric	5/-	48/9	+9d	20	30*	3	1	6	48/9	29/6
Bowthorpe Holdings	2/-	8/3	+3d	27	18½	4	9	9	11/6	7/9
Brit. Elec. Resistance	2/-	10/-		15	17½	3	10	0	10/3	5/6
Brit. Elec. Traction:										
Def. Ord. "A"	5/-	45/6		35	40	4	8	0	49/3	42/-
B.I. Callender's	£1	50/6	+2/-	13½	13½	5	7	0	61/-	47/9
B.I. Callender's 6% Pref. ...	£1	19/-		6	6	6	6	3	21/-	18/6
British Thermostat	5/-	30/-	+3/-	35	20*	3	6	9	30/-	21/3
Brook Motors	10/-	49/		25	25*	4	7	6*	53/6	43/9
Bulgin, A. F.	1/-	9/-		50	55	4	1	3*	10/3	8/-
Bulpitts	5/-	18/6	−6d	15	16½	4	7	9	23/3	16/9
Burco Dean	5/-	8/9	−9d	18	15‡	8	11	6	15/9	8/9
Cable & Wireless	5/-	16/3	−3d	10	10*‡	3	1	6	18/3	14/3
Chloride El. Storage "A" ...	£1	77/-		20	17½*	4	11	0	81/-	65/6
Clarke Chapman	£1	48/-		13¾	13¾	5	14	6	63/9	45/-
Cole, E. K....	5/-	20/9	−6d	20	22½	5	8	6	31/9	19/9
Combined Elec. Mfrs.	4/-	8/6	+3d	—	12½‡	5	17	9	8/6	8/-
Contactor Switchgear	5/-	14/9		14	14	4	15	0	17/9	14/6
Cossor, A. C.	5/-	5/-	−3d	5	Nil		—		10/-	5/-
Crabtree	10/-	29/3	−1/-	20	12½*	4	5	6	39/6	24/-
Crompton Parkinson	5/-	11/3	+6d	14	12½*	5	11	0	15/-	10/9
Davis & Timmins	5/-	31/3	+3d	20*	30‡	4	16	0	35/-	17/-
De La Rue	10/-	57/6	−1/3	22½	22½*‡	3	18	3	78/6	47/9
Decca "A"	10/-	51/3	+3/9	20	23⅓	4	12	6	51/3	40/9
Desoutter	5/-	50/-	+1/3	21⅞	30	3	0	0	50/-	37/6
Dewhurst	2/-	7/9		20	20	5	3	3	8/6	7/-
Dictograph Tel.	2/-	9/3	+6d	20	20*	4	6	6	9/9	7/9
Dimplex	5/-	44/6		—	30	2	16	3*	44/6	22/6
Dubilier Condenser	1/-	2/3	−3d	25	30	6	13	3*	3/3	2/3
Duport	5/-	22/3	−9d	17½	20	4	10	0	30/3	21/9
E.M.I.	10/-	45/-	+1/-	20	17½*	3	17	9	58/9	43/6
Electrical Apparatus	5/-	17/3		14½	20	5	16	0	18/3	2/9
Electrical Components	5/-	9/6		15	11½*	6	1	0	13/9	9/6
Elec. Construction	£1	34/3	−2/-	9	9	5	5	0	43/-	31/3
Elliott-Automation	5/-	27/-	+6d	9·3	12‡	2	4	6	36/-	19/9
Enfield Rolling Mills	£1	49/-	+1/-	15	15	6	2	6	56/-	48/-
English Electric	£1	33/9	+9d	14	10*	5	18	6	53/-	32/6
English Electric 3¾% Pref. ...	£1	11/9		3¾	3¾	6	7	9	13/-	11/-
Ericsson Tel.	5/-	21/9x.r.		13†	13†	4	17	6	28/6	21/6
Ever Ready	5/-	31/9	−3d	27½	20*	3	3	0	34/6	23/-
Falk Stadelmann	£1	24/3	−9d	10	7½	6	3	9	35/9	24/3

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

ance. The shares offer a yield of just over 5½ per cent.

Pye-E. K. Cole

Shares concerned with the Pye-Ekco amalgamation were quoted a few pence lower after the circulation of the formal invitation to shareholders to exchange their shares for those of the British Electronic Industries Company which has been formed to give effect to the proposals. Combined profits of the two groups for the year ending next March are expected by the directors to come out well below the 1959–60 level of just over £3 million, in the absence of an early upsurge in the sale of television sets. There is consequently no firm dividend forecast, although it is hoped that the rate will be 15 per cent. This would give the shareholders of both companies the same return as they have had from the present year's dividends, and on the basis of current share prices would produce a yield of about 5¼ per cent on the equity of the new company.

Ericsson Issue

Orders received by Ericsson Telephones in the first three-quarters of this year were 42 per cent more than in the same period of 1959. This information is given in connection with the issue of 1·6 million new 5s shares, which are offered by way of rights to existing shareholders at a price of 18s each. Early transactions were at a premium of 3s 9d. Proceeds of the issue are to be used principally in reducing temporary borrowing: by the end of last month bank loans had reached nearly £1½ million, largely as a result of the big increase of work in progress. Profits for the full period are expected by the directors, with the usual reservations, to show a satisfactory improvement, and to provide for the maintenance of the final dividend at 9 per cent net, as before, on the larger capital. On a total distribution of 13 per cent, tax-free, the new shares at an all-in price of 21s 9d offer a gross yield of 4·9 per cent. They will be transferable free of stamp duty for the next few weeks.

E.M.I. Prospects

In the year ended last June, sales of the Electric & Musical Industries group rose by 2 per cent and profits (before tax) by 9 per cent. Reviewing prospects for the current year, Sir Joseph Lockwood refers in the annual report to a slackening of economic expansion in many parts of the world and foresees some deceleration in the rate of E.M.I.'s progress as a result. All the same, the chairman expects some increase in sales, apart from contributions from new members of the group, to which Morphy-Richards has been added since the date of the accounts. Two-thirds of last year's turnover was accounted for by overseas sales, and half of it by gramophone records. At 45s, the 10s shares remain not very much above the lowest point of this year, in the early part of which they were quoted up to 58s 9d. They yield nearly 4 per cent on the 17½ per cent dividend, covered 2¼ times by earnings.

Electrical Investments

Company or Board	Nom. Value	Middle price 21st Nov.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1960 Highest	1960 Lowest
Electrical Shares—continued						£ s d		
G.E.C.	£1	33/9	+9d	10	10	5 18 6	47/6	32/9
G.E.C. 6½% Pref.	£1	20/6		6½	6½	6 6 9	22/3	19/6
General Cables	5/-	4/3		15	Nil	—	10/-	4/9
Goblin (B.V.C.)	5/-	6/6	−3d	7½	12½	9 12 6	13/9	6/6
Hackbridge Holdings	5/-	6/9		20	20	7 8 3*	8/9	6/9
Harland Engineering	5/-	15/-		14	16*	5 6 9	16/3	13/-
Head Wrightson	5/-	24/-		20	14*	2 18 3	31/6	20/6
Heatrae	2/-	11/3		20	22½	4 0 0	12/3	8/9
Holophane	5/-	17/-		26	30	8 16 6	20/6	17/-
Hoover	5/-	49/-	+4/9	60	90	4 11 9*	55/-	39/6
Intl. Combustion	5/-	26/-	+1/-	30	30	5 15 6	46/9	23/3
Intl. Computers & T.	£1	66/3	−1/3	—	10	3 0 3	78/6	61/6
Johnson & Phillips	£1	17/9		5	Nil	—	24/-	17/9
Laurence Scott	5/-	17/3		15	15*	4 7 0	25/3	17/3
Lister, R. A.	£1	52/-	−1/-	12½	14	5 7 9	62/-	52/-
Lucas, J.	£1	60/-	+1/3	12½	13¾	4 11 9	74/6	58/9
Marryat & Scott	2/-	14/9		22½	27½	3 14 6	16/9	14/-
Mather & Platt	£1	45/9	−1/9	10⅝	11	4 16 0	59/-	45/-
Metal Industries	£1	54/6	−1/9	14	15	5 10 0	76/3	54/6
Midland Elec. Mfg.	£1	60/-		10	12	4 0 0	61/-	53/6
Murex	£1	40/-	+1/3	15	20	5 14 0*	45/-	35/6
Newman Ind.	2/-	5/3		10	12½	4 15 3	5/3	4/-
Oldham & Son	1/-	2/3		17½	17½*‡	7 15 6	3/-	1/9
Parsons, C. A.	£1	47/6	+1/9	8½	9⅜	3 19 0	59/-	44/-
Philips' Lamps	Fl.10	227/6	−7/6	13·3	17	1 9 6	£12¾	137/-
Plessey	10/-	47/-	−1/-	15½‡	17‡	3 12 6	60/-	44/3
Pye	5/-	14/6	−6d	12½	15	5 3 6	19/-	14/6
Pyrotenax	5/-	49/-		34	40	4 1 9	56/-	44/3
Radiation	£1	28/9	−9d	6	12	8 6 9	44/6	28/9
Reliance-Clifton	5/-	25/-	−6d	15	15	3 0 0	28/-	22/-
Reyrolle	£1	38/3	+3/-	17½	17½	4 11 6*	52/3	33/9
Richardsons Westgarth	10/-	7/6		8⅛	8⅛	10 17 0	14/9	7/6
Sangamo Weston	10/-	26/3		12½	11*	4 3 9	27/-	19/3
Simon Engineering	5/-	30/-	−1/3	—	26·6‡	4 8 9	33/-	29/3
Smith (England), S.	4/-	17/-	+6d	17½	20	4 14 3	20/-	15/6
Southern Areas	£1	14/6		Nil	5	6 18 0	16/-	13/-
Strand Elec.	5/-	13/3		20	14·6*	5 10 0	14/-	10/6
Sturtevant	5/-	13/-		15†	15†	9 8 0	24/3	13/-
Sun Elec.	5/-	17/6		15	18½	5 5 9	17/6	15/-
T.C.C.	10/-	42/-	−1/6	25	35	5 13 6*	48/3	37/3
Telephone Rentals	5/-	22/9		12½	15*	3 6 0	24/-	17/-
Thompson (John)	5/-	16/-	+6d	25	20	6 5 0	25/9	15/6
Thorn Elec.	5/-	45/6		20	25	2 15 0	55/6	44/3
Thornycroft	£1	20/3	−1/9	6	6	5 18 6	31/-	20/3
Tube Investments	£1	78/6	−1/6	—	14	3 11 3	95/6	65/3
Ultra Electric	5/-	15/6	+3d	20	25	8 1 3	29/-	15/-
Vactric	5/-	1/6	−9d	37½	15	—	43/9	1/6
Walsall Conduits	4/-	11/6		22½	15*	5 4 3	16/-	11/6
Ward & Goldstone	5/-	28/-		30	35	3 2 6*	31/3	25/6
Watford	2/-	8/3	+3d	25	25	4 17 0*	14/-	7/6
Westinghouse	£1	41/3		10	11	5 6 9	59/9	41/3
West, Allen	5/-	11/3	−6d	12½	12½*	5 11 0	17/-	11/3
Wilkins & Mitchell	5/-	13/6	−1/-	17	21*	7 15 6	25/9	13/6
Wolf Electric	5/-	14/6	+3d	10	12½	4 6 3	14/9	10/9

REPORTS and DIVIDENDS

Tube Investments, Ltd.—In his annual statement Sir Ivan Stedeford (chairman) says "We must needs spend more to earn more or to avoid being out-dated. Official restraints cutting back domestic expenditure on industrial re-equipment is an economy the country can ill afford. Technology does not pause for economic recovery, nor indeed for the funds with which to exploit it."

Referring to the electrical side of the business, Sir Ivan says the official measures in the spring to check public spending were more in the nature of a thumb-screw operation for the domestic electrical appliances industry than a squeeze; it is still painful. The pressure came when the industry had well passed the zenith of the demand of the previous year, with sales already down to a moderate level. Growing stocks in the hands of the trade had already begun to restrain the demand on the factories.

The Electrical Division has felt the full effect of these restrictions imposed on a contracting demand. Its earnings are down, and are likely to remain suppressed until the housewife is again allowed to satisfy her need for kitchen equipment in the only way in which these domestic goods can be purchased by most people.

Further "Creda" models incorporating many innovations in design will further extend the range next year. Simplex continue also to expand their range of industrial installation equipment. In a year of improved results on this side of the business, development has continued in the fields of automatic gear and industrial lighting equipment.

Other companies in the Electrical Division generally had a better year. The Power Centre Co., Ltd., has benefited from the new factory at Wednesbury and shown improved figures. Mersey Cable Works, Ltd., has, however, had another difficult year contending with the disordered conditions of the whole cable industry. Gowshall, Ltd., has held its own well in the keenly competitive market for road signs and street furniture.

The accounts were summarised in the 11th November issue of the *Electrical Review*.

Pye-Ekco Prospects.—Unless there is an early and marked upsurge in sales of television receiving sets the combined profits of Pye and E. K. Cole and particularly the latter for the year ending 31st March, 1961, will be substantially lower than the £3,015,393 before tax achieved in 1959-60. This is stated in the formal offer by British Electronic Industries, Ltd., for the capital of the two companies. In the circumstances, therefore, and subject to the offer becoming binding, the board of B.E.I. must await the full year's results of both groups before considering the dividend. It is hoped, however, to pay 15 per cent, the equivalent of that paid by the two companies in 1959-60. At 31st March, 1960, the net assets of the two companies amounted to £18,799,475, of which £14,471,321 was attributable to Pye and £4,328,154 to E. K. Cole.

Electric & Musical Industries, Ltd.—In his review circulated with the accounts (*Electrical Review*, 7th October) Sir Joseph Lockwood (chairman) points out that almost everywhere the pace of economic expansion is flattening and in many parts of the world it may give way soon to some measure of recession. In the circumstances the progress of the E.M.I. group of companies will inevitably be slowed down, although he is confident that there will be a modest increase in total sales this year, apart from the increase which must accrue from the companies which have recently joined the group.

This cautious optimism is possible, he says, because the group is more than holding its own in the world markets and because the diversity of the group's products helps to stabilise total turnover in spite of changes in the general level and the composition of business activity. When, in order to contain inflationary pressures, the demand for consumer durable goods is deliberately pulled down by governmental restrictions, it has often been found that the pattern of spending is changed and the demand for other group products, such as gramophone records, rises. Moreover, the group attracts a growing proportion of national investment expenditure with its range of electronic capital goods, many of which contribute powerfully to a reduction in the cost of administration and manufacture.

Last year about half of the group turnover was represented by gramophone records, the remainder comprising electronic capital goods, radio and television, domestic electrical appliances, magnetic tape and some office equipment. Total capital expenditure by the group was £2,523,000; a little over £1 million was spent in the United Kingdom and a large proportion of this was for the steadily growing electronic business. E.M.I. Electronics, Ltd., doubled its export business during the year. The report, which is most handsomely produced with many colour photographs, contains a detailed review of the activities of all the group's subsidiary companies at home and overseas.

Plessey's Results as Forecast.—As forecast with the one-for-two "rights" issue of last September, the consolidated profit before tax of Plessey & Co., Ltd., amounted to £4,300,884 in the year ended 30th June, 1960, against £2,236,119, and the final dividend is 8½ per cent. This dividend, which is not payable on the new shares arising from the "rights" issue, makes 15½ per cent for the year (against 13 per cent). Last month Plessey made a bid for the capital of the Garrard Engineering & Manufacturing Co., Ltd.

Crompton Parkinson, Ltd.—Mr. A. Parkinson (chairman) believes that a further intensification of competition is inevitable and the regroupings which have taken place in the electrical industry in this country can, in the course of time, be expected to increase this still further.

It is also believed, he adds, that expansion and growth, which are a definite part of the board's policy, can in many ways help to improve the group's competitive position. It is, however, not the intention to sacrifice efficiency in the pursuit of enlargement.

Undoubtedly, Mr. Parkinson continues, the diversification of the group's activities has been and will continue to be of great influence in maintaining a steady and even trading performance.

The special plight of the cable industry during the past twelve months has, Mr. Parkinson says, considerably affected the profits of the company. The intense competition and the very narrow profit margins which have been the lot of those engaged in this industry are well known. Manufacturers of some types of cable with which the company are concerned have reported publicly that in order to maintain a share of the market they have had to sell cable below the cost of the raw materials consumed. Had Crompton's own cable factory not been well equipped and efficiently operated they would undoubtedly have suffered to a greater degree than in fact proved to be the case. This period of wasteful and unrealistic competition has now been succeeded, Mr. Parkinson declares, by one in which prices for some cable products are still not providing a fair or sufficient return to the manufacturer, but the market in

[*Continued on page* 929

Full details available from:
THE GENERAL ELECTRIC CO LTD OF ENGLAND
Switchgear Division, Birmingham 6.

Greater safety for hands

TRIUMPHS OF SHELL RESEARCH

With new Shell Dromus Oils

Most modern soluble cutting oils contain phenolic compounds used as coupling agents between the oil and the emulsifier, for better blending and easier mixing. These phenolic compounds can cause skin irritation, especially where modern high-speed machines are used and the emulsion can concentrate, through the evaporation of water, above the safety level.

Shell research chemists have been working on this problem, which has been causing some concern to Management. After considerable research, Shell Dromus Oils have been reformulated and these new cutting oils now produce bland emulsions, which considerably reduce the risk of skin trouble to operators.

The real difficulty was to find a new coupling agent to replace the phenolic compounds, and Shell finally used what their chemists know as a higher fatty alcohol complex. This solved one problem, but presented another. The new coupling agent was volatile at the high temperatures normally used in blending processes. Further research found a solution to this problem by designing and installing new plant.

The new Dromus Oils are every bit as efficient as before and cost no more. They put Management in the welcome position of being able to minimise working hazards at no extra cost. And machine men need no longer be so worried about skin troubles.

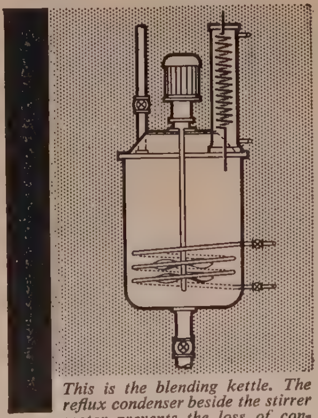
The moral of the story is that Shell research is supremely applicational. The centre at Thornton is always ready to work with even the most specialised sectors of industry to produce the right oil for the job. If you and your organization have any major lubricating problems, it pays to get in touch with your local supplier of Shell Industrial Lubricants.

The Research Story

Shell chemists in the U.K., in Holland and in the U.S.A., prepared and examined hundreds of experimental soluble oils, and established that certain combinations of fatty alcohols could be used in place of phenolic compounds with no loss of efficiency. They set to work to discover the best combination and developed a higher fatty alcohol complex which fitted exactly. Then they realised that to blend this new coupling agent into soluble oils would require special plant and new blending techniques.

Exhaustive testing of blend stability, emulsion stability, anti-corrosion and machining properties led to selection of the most promising blends. A pilot plant was set up to produce batches of these for use in field trials.

This field testing and final development proceeded for two years whilst production plants were erected at points so chosen as to give the most economical and rapid delivery throughout the United Kingdom.



This is the blending kettle. The reflux condenser beside the stirrer motor prevents the loss of constituents volatile at the blending temperature.

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another proof of Shell leadership in lubrication

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FINANCIAL SECTION *[continued*

general now has a basis of some stability and under these conditions reasonable profits can once more be attained.

The growth of its activities overseas in manufacturing, merchanting, and contracting is giving the company international status and at the same time making further valuable contributions to Great Britain's overseas earnings.

The past year has been one of great activity during which the company's factories have in general been fully occupied and good progress has been made. On the other hand, the increase in competitive conditions and the break up of many of the national trading associations which maintained stable prices have produced a situation which must inevitably have a depressing influence on profit and which can only be offset by ensuring that both the quality and efficiency of the company's products and the methods by which they are made are of the highest standard.

S. Smith & Son (England), Ltd., report a group trading profit for the year ended 30th July, 1960, of £4,190,708 (against £3,603,977). After deducting taxation and minority interests the net balance attributable to the parent company is £2,286,915 (against £1,907,730). Group sales rose by 14 per cent to £40·6 million. It is proposed to pay a final dividend of 15½ per cent, making 20 per cent for the year (against 17½ per cent).

Elliott-Automation, Ltd., has declared an interim dividend of 5 per cent for 1960 on capital increased by one-for-five "rights" and scrip issues and by the issue against the acquisition of the Rheostatic Co., Ltd. A total of 12 per cent was foreshadowed at the time of the Rheostatic bid. Last year's payments were an interim dividend of 4 per cent—equivalent to 3⅓ per cent adjusted for the capitalisation—and a final dividend of 6 per cent after the "rights" and scrip issues.

British Columbia Electric Railway Co., Ltd.—The directors announce that it has been decided that the company should be voluntarily wound up.

Enfield Rolling Mills, Ltd., has declared an interim dividend of 2½ per cent (the same).

New Companies

Smith's Electrics (Enfield), Ltd.—Registered 27th September. Capital £2,000. Directors: L. Smith and G. Smith. Secretary: Mrs. P. A. Smith. Regd. office: 134, Chase Side, Enfield, Middlesex.

Technic Electrics (B'ham), Ltd.—Registered 19th October. Capital £1,000. Exporters and importers of and wholesale dealers in and manufacturers of electrical appliances, etc. Directors: A. W. G. Newbery, W. A. Newbery and W. K. Bryan. Secretary: Eloise B. Newbery. Regd. office: 891, Pershore Road, Birmingham, 29.

Hounslow Heath Electrical, Ltd.—Registered 27th September. Capital £100. Buyers and sellers of, dealers in and manufacturers of electrical and electronic apparatus and goods, etc. Directors: Mrs. Rosemary S. Bailey, 12, Stratton Road, Sunbury-on-Thames and J. Bailey, 381, Staines Road, Hounslow, Middlesex.

G. T. M. Lampkin, Ltd.—Registered 25th October. Capital £1,000. Electrical contractors and engineers, etc. Directors: G. T. M. Lampkin and Mrs. Alma E. Lampkin. Secretary: Sheila M. Riches. Regd. office: 3, Acorn Road, Gillingham, Kent.

Arthur Gardner (Electrics), Ltd.—Registered 26th October. Capital £100. Merchants of and dealers in all kinds of electrical goods; electronic and electrical engineers and contractors, etc. Directors: A. MacNally and R. G. Logan (directors of McNally & Logan, Ltd.). Secretary: R. G. Logan.

Electric House (F.G.H.), Ltd.—Registered 31st October. Capital £1,000. Retailers, suppliers, manufacturers, wholesalers, importers and exporters of and dealers in washing machines, refrigerators, vacuum cleaners, television, radio, etc. Directors: F. G. Harding and Eva R. Harding (secretary). Regd. office: 929, Rochdale Road, Manchester, 9.

Self Answering Telephone Co., Ltd.—Registered 31st October. Capital £100. Directors: H. Potts, W. A. Burnside and R. W. Newman. Secretary: C. B. Edwards. Regd. office: 6, Chandos Street, W.1.

C.B.S. (Electrical Motors), Ltd.—Registered 31st October. Capital £1,000. Directors: J. E. Truelove and J. H. Bartram (secretary). Regd. office: Barnwell House, Newmarket Road, Cambridge.

Leslie Hobbs, Ltd.—Registered 31st October. Capital £1,000. Manufacturers, importers, exporters and distributors of, agents for and wholesale and retail dealers in electrical goods, radio and television receivers, etc. L. C. Hobbs is the first director. Secretary: Jean L. Hobbs. Regd. office: 42, Devonshire Street, W.1.

Clayton Electrical Industries, Ltd.—Registered 27th October. Capital £1,000. Electrical engineers and contractors, television and radio engineers, etc. I. Bardsley is the first director. Secretary: F. Broadie. Regd. office: Fairclough Street, Clayton, Manchester, 11.

A.C.D. Productions (High Wycombe), Ltd.—Registered 27th October. Capital £500. Manufacturers and designers of automatic control equipment, etc. Directors: L. T. F. Bryan and B. Hazlegrove. Secretary: W. J. Shrimpton. Regd. office: 57, Amersham Hill, High Wycombe.

A.C.D. Sales (High Wycombe), Ltd.—Registered 27th October. Capital £500. Exporters, merchants of and dealers in automatic control equipment, etc. Directors: L. T. F. Bryan and Violet A. Bryan. Other particulars are similar to A.C.D. Productions (High Wycombe), Ltd.

Trade Contractors (Electrical), Ltd.—Registered 28th October. Capital £1,000. Electricians, etc. Directors: R. Moloney and R. F. Fabian (secretary). Regd. office: 4, Spring Street, W.2.

Holden's Electrical, Ltd.—Registered 28th October. Capital £1,000. To acquire the business of dealers in electrical domestic appliances now carried on by H. C. Holden and June Holden at 74, Banktop, Blackburn. Directors: H. C. Holden (chairman) and June Holden (secretary). Regd. office: 74, Banktop, Blackburn, Lancs.

Shelley Electronic Development Laboratories, Ltd.—Registered 7th November. Capital £100. Research physicists, chemists, mechanical, electrical, electronic and chemical engineers, etc. Directors: L. G. Sebestyen and H. N. Wylie (secretary). Regd. office: 28a, Basinghall Street, E.C.2.

Induction Furnace Installations, Ltd.—Registered 2nd November. Capital £2,000. Designers, installers, manufacturers of and dealers in equipment, plant, machinery and accessories required for the heating of metals and non-metals by the application of heat produced by electrical or other means, etc. Subscribers: J. Byron, 5, Ashview Close, Ashford, Middlesex, and Mrs. Christine Crow, 51, Farrance Road, Chadwell Heath.

Braemar Electrical Co., Ltd.—Registered 7th November. Capital £100. Directors: J. R. W. Day-King, C. J. Saunders and E. J. Course (secretary). Regd. office: Braemar Works, Braemar Road, E.13.

Gordon Mustoe, Ltd.—Registered 4th November. Capital £100. Manufacturers of and dealers in vacuum cleaners, etc. Directors: G. F. A. Mustoe and Mrs. Monica C. Mustoe (secretary). Regd. office: 5, Tivoli Place, Cheltenham, Glos.

Southern Economics, Ltd.—Registered 7th November. Capital £1,000. Wholesale and retail dealers in domestic electrical appliances, equipment and utensils of all kinds, etc. Directors: T. G. Pope and F. A. Rayner. Secretary: Carol A. Rayner. Regd. office: Portland Chambers, West Street, Fareham, Hants.

Meeting of Creditors

Don Electrical Co., Ltd.—Meeting 28th November at 93, Queen Street, Sheffield.

Liquidations

Phoenix (Electrical Contractors), Ltd.—Meeting of members 13th December at Tudor Court, 52, Richmond Road, Worthing, to receive an account of the winding-up by the liquidator, Mr. F. R. Hews.

Tern Electrics, Ltd., 82, Canal Street, Nottingham.—Winding-up order made on 7th November.

Shadbolt Bros., Ltd., electrical retailers, 153, Chase Side, Enfield, Middx.—Last day for receiving proofs for dividend today (Friday). Liquidator, Mr. R. A. Rodgers, 25, Bedford Row, London, W.C.1.

William B. Abel & Son, Ltd., radio, television and electrical engineers, 143, Fisherton Street, Salisbury.—First dividend of 2s in the £ payable at the offices of E. T. Collins & Son, 28, Baldwin Street, Bristol.

Campbell & Jordan, Ltd., electrical appliance retailers, 32-34, Rupert Street, Piccadilly Circus, London, W.1.—Liquidator, Mr. F. M. Collins, Inveresk House, 346, Strand, London, W.C.2, released 28th October.

Bankruptcies

Television Services (Longsight), electrical equipment sales and service engineers, 8, Longsight Road, Holcombe Brook, Bury, Lancs.—First meeting held 18th November. Public examination 1st February at the Court House, Mawdsley Street, Bolton.

H. G. Duff, radio, television and electrical dealer, residing and carrying on business at 4, Halliday Grove, Leeds, and previously carrying on business at 7, Canal Road, and 8, Dodsworth Court, Leeds.—First meeting held 18th November. Public examination 17th January at the County Court House, Albion Place, Leeds.

R. A. Gibson and **P. L. Long**, lately carrying on business in co-partnership as Gibson & Long at 9, Beech Road, Horfield, Bristol, electrical and plumbing contractors.—Trustee, Mr. G. C. Ehlers, 28, Baldwin Street, Bristol, appointed on 7th November.

C. P. Wheeldon, electrical and general dealer, lately carrying on business at Bryn Awel, Brunswick Road, Buckley, Flints.—Last day for receiving proofs for dividend today (Friday). Trustee, Mr. R. P. Booth, 5, Rumford Place, Chapel Street, Liverpool.

R. G. Fitzpatrick, formerly carrying on business as South Wales Vacuum Services at 7, Westgate Chambers, Newport, Mon., retailer of domestic electrical appliances.—Receiving order made 10th November on debtor's petition.

C. Sykes, electrician, 10, High Kepplewray, Broughton-in-Furness, Lancs.—Order for discharge made 12th October, suspended for three months.

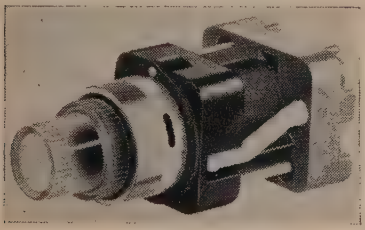
NEW ELECTRICAL EQUIPMENT

Infra-Red Heater

The new "Barry" infra-red radiant heater, manufactured by the GRUBB ENGINEERING CO., LTD., Mary Street, Birmingham, 12, has a loading of 1 kW and is 24in long. The heater, designed for wall-mounting, is provided with a pull-cord switch and is fitted with a chromium plated guard. The finish is in hammered gold or silver and cream and the price is £4 7s 6d plus 16s purchase tax.

Illuminated Push-Button

An addition to their heavy duty, oil-tight control unit range is announced by SQUARE D, LTD., Cheney Manor, Swindon, Wilts. Designated Class 9001 Type TP, it is an illuminated push-button which combines the functions of a double circuit push-button switch and transformer type pilot light in one unit. The pilot light lens, when depressed, operates the contacts of a single-pole double throw contact block. The illumination circuit is separate from the push-button circuit. This makes it possible for the light to be "on" whilst the lens is depressed only or, alternatively, to remain "on" after the lens has been depressed and released, according to the external wiring arrangement. Pilot light lenses are available in red, green, amber, blue, clear and white. Illumination is provided by a 6-8 V miniature bayonet lamp operated from a transformer. This unit, incorporating the transformer, is available for supply voltages ranging from 110 to 600 V at frequencies varying between 25 and 60 c/s. Although normally supplied without a guard, an extended bakelite lens guard can be provided as an additional feature.



Square D illuminated push-button

Level Control System

The vibrating probe type level control system manufactured by FIRTH CLEVELAND INSTRUMENTS, LTD., Treforest, Glam., gives a visual indication when the liquid or granular content of a tank or hopper reaches the probe unit and stops the vibrations. The system, which can also be used to control the tank filling and emptying mechanism, consists of a probe unit which comprises the detecting device, and a control amplifier unit which incorporates the control relay and lamp indicators.

The probe unit is mounted on the tank wall to allow horizontal penetration of the vibrating member into the tank and is satisfactory for use in tank pressures up to 250 p.s.i. An aluminium bronze cast housing contains an isolated magnet and coil assembly which vibrates the extended rod in the tank.

The amplifier unit consists of a die-cast aluminium alloy case containing the energising circuit for the control relay which illuminates one of the coloured warning lamps on the cover of the unit appropriate to the state of the tank contents.

Interconnection of the units can be made up to a cable length of 300ft. The circuit is of a fail-safe design to give protection in the event of mains supply failure or short circuit in the probe unit wiring. Operating temperatures for the probe unit range from −40 to 200°C, and for the amplifier unit from −10 to +50°C. The probe unit is not affected by extraneous magnetic or electric fields.

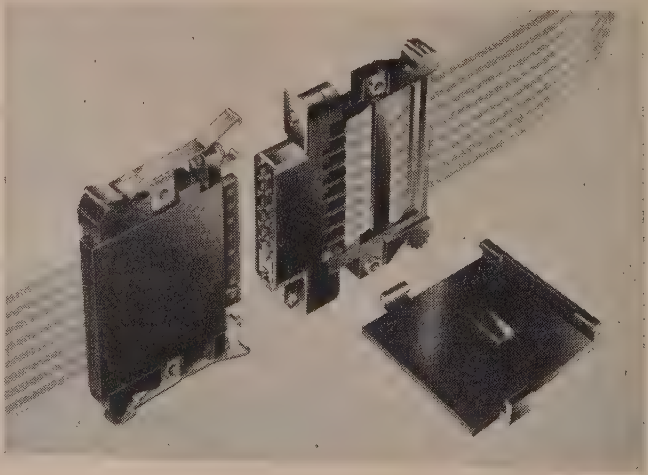
Flexible Ribbon Cable

A flat-form multi-way cable consisting of flat copper conductors disposed in parallel paths between two tapes of Melinex/polythene laminate has recently been announced. Developed jointly by the TELEGRAPH CONDENSER CO., LTD., North Acton, London, W.3, and BRITISH INSULATED CALLENDER'S CABLES, LTD., 21, Bloomsbury Street, London, W.C.1, and known as "Flexistrip," it is manufactured with 4, 8, 12, 18 and 26 conductors on a 0·15in module and in ratings of 2·5 and 5 A. Depending on the current rating the cable is either 0·011 or 0·14in thick. The recommended maximum working voltage is 500 V a.c. and the instantaneous breakdown voltage in water is not less than 3 kV r.m.s. The minimum insulation resistance at 20°C between conductors and from conductors to earth is 20 MΩ/1,000 yd after a stress of 500 V d.c. for one minute. In free air, the capacitance between conductors is not greater than 15 pF/ft. The maximum operating temperature is 70°C. The cable is available in 50 and 100 yd rolls, the price being between 4s 3d and 26s 6d depending on the current rating and the number of conductors.

Ribbon Cable Connector

A range of connectors for use with the "Flexistrip" ribbon feeder described above has been produced by BELLING & LEE, LTD., Great Cambridge Road, Enfield, Middlesex. These connectors have identical housings for the plug and socket portions, comprising a moulded body with a snap-on lid and containing a standard printed circuit socket or a printed circuit board which constitutes the plug member. A locking device can be incorporated in the form of a spring steel retaining clip and polarising guides and a locating pin ensure correct polarity. The connectors are at present available in 8- and 18-way forms with a current rating of 3 A per contact and a voltage rating of 250 V a.c. or 350 V d.c. The contact resistance is less than 5 mΩ. During tests a pull of more than 30 lb was required to detach an 8-way cable from its terminations.

Belling & Lee connector for "Flexistrip" ribbon cable



Fluorescent Fitting

A new fluorescent light fitting, the "Mazda Netaline Luminaire," has been introduced by the A.E.I. LAMP & LIGHTING CO., LTD., Melton Road, Leicester. At present it is obtainable only in the company's north-west sales region (Cumberland, Westmorland, Lancashire, Cheshire and parts of North Wales), though it will be marketed in other sales territories in due course.

Designed by Hugo G. Poole, M.S.I.A., the fitting is of cantilever construction for direct ceiling suspension. It is sold fitted with a 4ft 40 W "Warm White" lamp, which operates on a resistance wire circuit from a 230/240 V supply. It is light in weight (3$\frac{3}{4}$ lb, length 56in) and easy to install, being suspended from only one point by a bracket attached to the ceiling by two wood screws. The "Netaline" is not only a domestic fitting but is also suitable for use in offices, shops, restaurants, etc. It is available in blue, yellow or lilac and both lamp and fitting are guaranteed for twelve months.

"Mazda Netaline" fluorescent fitting (A.E.I. Lamp & Lighting Co., Ltd.)

The price, complete with lamp and all the necessary fixing screws and wiring connector, is £3 19s 9d including purchase tax.

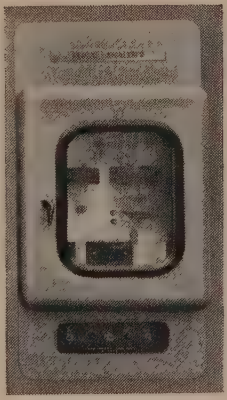
Crane Control System

A control system for dockside cranes has been developed in collaboration with Stothert & Pitt, Ltd., by MAWDSLEY'S, LTD., Dursley, Glos. Known as the "Mawdomatic," the scheme combines methods of Ward-Leonard control enabling the motor speed/torque characteristic to be matched to the load. This entails simultaneous automatic control of the d.c. motor and generator fields, achieved by adding to the conventional Ward-Leonard system an exciter with a voltage characteristic governed by the current in the armature loop circuit. This gives a light hook to full load speed ratio up to 4 : 1 and a dropping speed/load characteristic stable on lowering even when the speed is down to 66 per cent of the light hook speed.

The controller has a single joystick handle and a foot brake is unnecessary since the lowering is automatically controlled by regenerative braking. Heavy current switching is eliminated and no heavy current surges are reflected on the main busbars supplying the main motor-generator set.

Silica Analyser

An instrument for continuously analysing the silica content of boiler feed water is now being manufactured under licence by ELECTRONIC INSTRUMENTS, LTD., Richmond, Surrey. The instrument is essentially a colorimeter in which the colour of a solution to which reagents have been added is a measure of the concentration of silica in that solution. A measured sample of water is taken automatically, a fixed volume of molybdate solution and then the reducing agent being added. The stirred mixture eventually develops a blue colour and is then delivered to an optical comparator and the blue shade photo-electrically compared with a "Perspex" blank or, if the water is discoloured, with the original water.



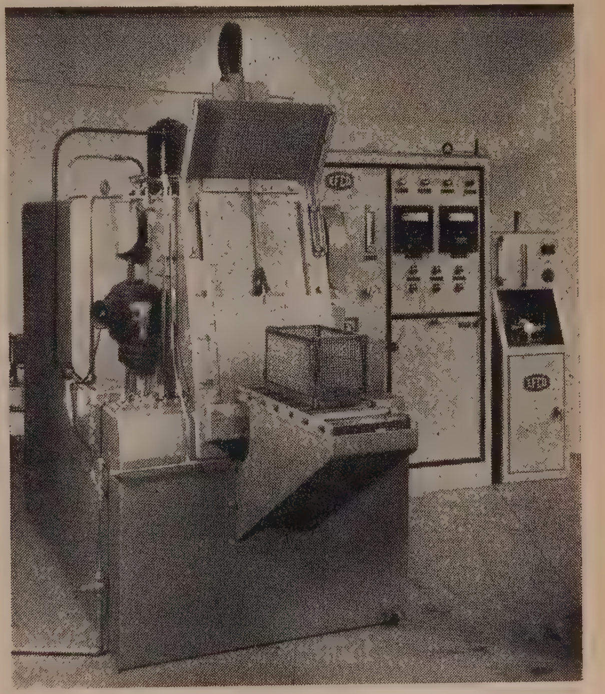
E.I.L. silica analyser

The instrument is available in three ranges: 0 to 0·2 parts of silica per million of water, 0 to 2·5 p.p.m., and 0 to 30 p.p.m. The complete cycle of operations takes twelve minutes.

The differential output of the photocells in the colorimeter feeds a transistor amplifier which gives an output of 1 mA into a resistance of 1,500 Ω for full-scale deflection. The output drives a suitable recorder. The instrument can be operated from a 110-120 V or 210-250 V, 50/60 c/s power supply, and its consumption is approximately 80 W.

Quench Furnace

A small size furnace has been introduced by the ELECTRIC RESISTANCE FURNACE CO., LTD., Netherby, Queens Road, Weybridge, Surrey, to provide closed-quenching facilities for processing small quantities of work. Designed for gas carburising, carbonitriding and carbon restoration, the furnace incorporates a horizontal heating chamber, a purging chamber and an oil quench tank, and is fitted at the front with a roller conveyor charging table. The work, in baskets, is moved into the furnace through an outer door fitted with a gas screen to prevent the ingress of air. Inside the purging chamber the work is supported on a single-deck charge elevator subsequently used to lower it into the oil quench. The heating chamber of the Efco "Junior" is fitted with radiant tube elements which are arranged for direct connection to a standard three-phase supply. These elements are rated at 15 kW and are arranged in a single control zone and provide furnace temperatures up to 950°C. The atmosphere within the chamber is circulated by a fan driven by a water-cooled motor. The oil quench tank is fitted with an oil cooler and a motor-driven oil agitator. The furnace accommodates work baskets 14in long by 8in wide by 8in high.



Efco "Junior" closed-quench furnace

NEW SEASON'S REFRIGERATORS

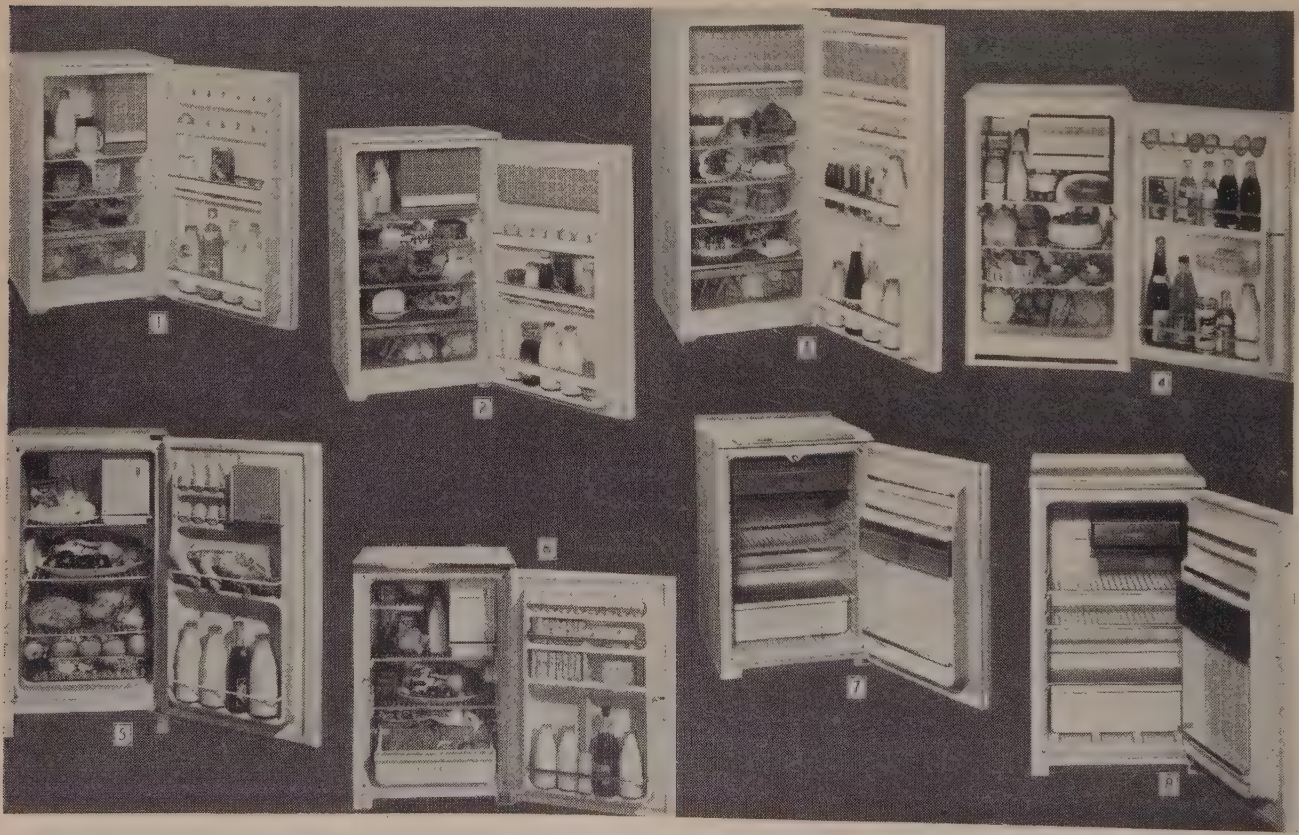
TWO new refrigerators have been announced by KELVINATOR, LTD., Great West Road, Chiswick, London, W.4, for the 1961 season. The first of these, the 3 cu ft "Lady K," is claimed to be the first of its size in which frozen foods and ice cream can be kept in perfect condition for periods up to three months. This is achieved by fitting a special freezer, known as the "Zero Plus," which, incidentally, is also to be found in the new 4·6 cu ft model and in the company's existing 6, 7·7 and 9·4 cu ft models. Apart from the new freezer, the "Lady K" has over 5 sq ft of shelf space, yet the dimensions are only $34\frac{7}{8}$in high by 19in wide by 19in deep. Internal furnishings include slide-out shelves, a chill tray, ice cube maker and, in the door, there are large egg and bottle racks, as well as a separate compartment for butter storage. The model can be free-standing, built-in or, if desired, hung on the wall. The finish is in white or ivory and the price is 50 gns, including purchase tax. A tray top is available as an optional extra.

The second new Kelvinator model (K.46ZP) has a capacity of 4·6 cu ft and 8·4 sq ft of shelf area. The finish and styling are similar to the "Lady K," except that this model has a large salad crisper, automatic interior light and is fitted with adjustable glider feet for ease of movement. It is $34\frac{11}{16}$in high by $25\frac{7}{8}$in wide by $22\frac{13}{16}$in deep. The price, including purchase tax, is £70 7s.

The company's four other models, which also incorporate the "Zero Plus" freezer feature, are being continued. The prices, including purchase tax, are: K60M (6 cu ft) £84; K77M (7·7 cu ft) £109; K94M (9·4 cu ft) £125; and K94MD (9·4 cu ft) £135. All Kelvinator refrigerators are of the compressor type, being driven by the company's "Polarsphere" unit, which is guaranteed for five years.

The new range of "SheerLook" refrigerators introduced by the FRIGIDAIRE DIVISION of GENERAL MOTORS, LTD., Stag Lane, Kingsbury, London, N.W.9, has been designed to take up the minimum of kitchen floor space. Included in the range is the smallest model yet to be made by Frigidaire—a 2·9 cu ft refrigerator priced at 49 gns, including purchase tax. The other models are 3·8 cu ft (59 gns) and 5·1 cu ft (69 gns). They are fitted with large freezer compartments, claimed to keep frozen food or ice cream in good condition for at least a month, and catches and door latches have been dispensed with. All the doors in the new range are fitted with air cushioned magnetic gaskets and all are equipped with interior lights. The smallest, 2·9 cu ft, model measures $33\frac{1}{4}$in high by 19in wide by $19\frac{5}{8}$in deep, enabling it to fit into any sink unit or other kitchen furniture. It has a 5 lb frozen food compartment, salad hydrator, adjustable shelving and a large door store which accommodates four pint milk bottles, as well as a rack for a dozen eggs. The 3·8 cu ft model is of table-top height yet occupies only 21in square of floor space. The freezer holds nearly 9 lb of frozen food and the bottle storage capacity, in the door space, can be augmented by the reversal of a top shelf in the cabinet. The de-luxe model (5·1 cu ft) stands 45in high yet occupies only the same floor space as the 3·8 cu ft model. It has a large size freezer compartment which goes right across the top of the cabinet and holds nearly 13 lb of frozen foods. Butter and cheese go

(Continued on page 933)



*A selection of 1961 refrigerators. Frigidaire "SheerLook" range—**1.** Model MB-30, 2·9 cu ft, **(2)** model MB-40T, 3·8 cu ft and **(3)** model DB-50, 5·1 cu ft. **4.** A.E.I.-Hotpoint model E.S.37, 3·7 cu ft. Kelvinator's two latest models—**5.** "Lady K," 3·1 cu ft and **(6)** model 46ZP, 4·6 cu ft. Gramophone Co.'s H.M.V. "Polar Star" refrigerators—**7.** Model GC.4, 4 cu ft and **(8)** model GC.5, 5·1 cu ft*

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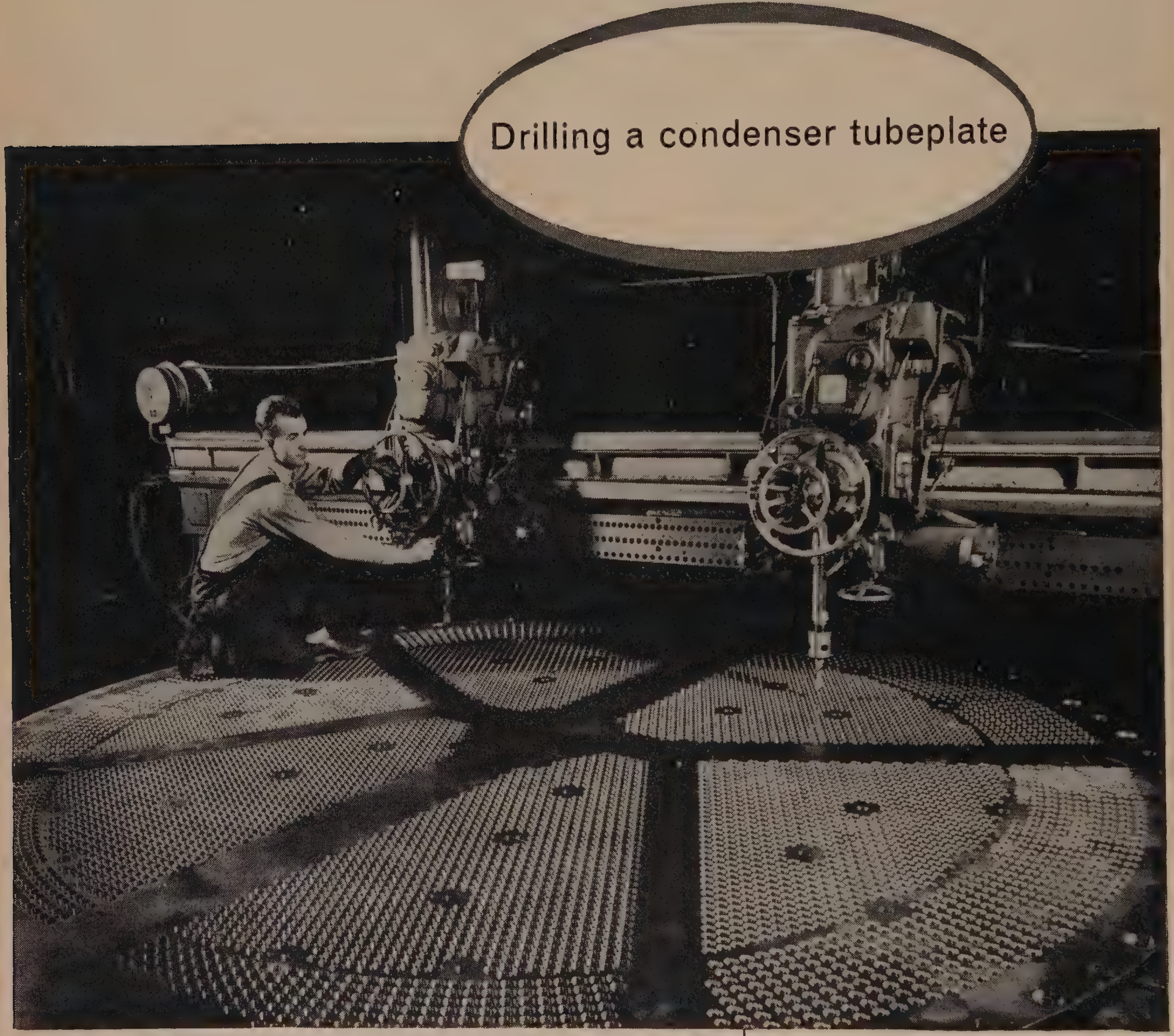

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NEW SEASON'S REFRIGERATORS [continued

into a separate door compartment, as well as fourteen eggs, and there is also room in the door for eight 1-pint milk bottles.

All new refrigerators are available in any of five colours—white, cream, pink, red or green, with the door handles in chromium. The interior liners are in white polystyrene and all are driven by the "Metermiser" hermetically sealed compressor unit, which is guaranteed for five years.

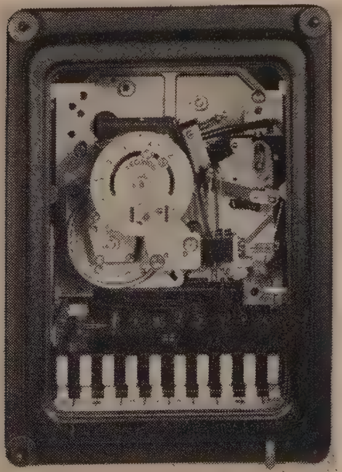
The two new refrigerators announced by the GRAMOPHONE CO., LTD., Blythe Road, Hayes, Middlesex, are the H.M.V. "Polar Star" refrigerators with respective capacities of 4 and 5·1 cu ft. They are of the compressor type, being fitted with a "Tecumseh" sealed unit, and are designed on modern squared-up lines. The smaller refrigerator measures 21in wide by $21\frac{1}{2}$in deep and the larger model measures 23in wide by $23\frac{1}{2}$in deep; both are $35\frac{7}{8}$in high. Special features include magnetic door sealing, rear castors for ease of movement, adjustable shelves, ample door space and a unique cabinet rack for small fruit juice or tonic bottles. The cabinet exteriors are finished in either white or ivory stoved enamel and the table-top finish is vitreous enamel in alternative colours of pale blue or maroon. The interior liner is made of polystyrene. They are priced at 61 and 69 gns respectively, including tax.

A.E.I.-HOTPOINT, LTD., 33, Grosvenor Place, London, S.W.1, announce that a new version of their "Iced Diamond" 3·7 cu ft refrigerator has been added to the range. Known as the ES.37, it is the standard version of the E.37 "Super" except that it has no kick strip, interior light, rollers, butter dish and salad bin and is available only with a right-hand hinged door. The cabinet dimensions ($34\frac{7}{8}$in high by 21in deep by 21in wide) remain the same. It is available in a white or cream cabinet with white polystyrene liner and the price, including purchase tax, is 53 gns.

NEW EARTH FAULT RELAY

A new sensitive earth fault relay designed to give protection against faults not seen by normal inverse definite minimum time (IDMT) relays is now being produced by the English Electric Co., Ltd. This CMU relay has a minimum setting of 0·1 A, which is equivalent to a setting of 2 per cent of normal fault load with current transformers having a 5 A secondary rating. As the burden imposed on the current transformers by the relay is very small (0·005 VA), the effective primary setting is almost equal to the actual relay setting.

The measuring element is a sensitive d.c. polarised relay, type CMG, supplied with the rectified output from a saturable current transformer which receives the earth fault current from the main line current transformers. The closing of the polarised relay contacts operates an adjustable timing unit, type VAT (2-10 sec). This ensures that the relay does not trip the circuit-breaker until the main earth fault protection has had time to disconnect the faulty section. The polarised relay has two coils for series or parallel connection by means of links. With the coils in series, a setting of 0·1 A is obtained but a parallel setting may be used to give a pick-up current of about 0·15 A. The use of a saturable current transformer gives the relay a high thermal rating (100 A for 10 sec or up to a maximum of 200 A for $2\frac{1}{2}$ sec). The relay is available either as a self-resetting or a hand resetting type.



English Electric sensitive fault relay type CMU

The CMU relay is one of the items being demonstrated in an English Electric mobile exhibition which will visit various centres in this country. A single shot auto-reclose scheme will also be demonstrated. This relay provides one reclosure of the circuit-breaker on each fault and if the reclosure is successful the scheme will reset in readiness for the next reclosing operation. If the fault is persistent, the scheme will lock-out the breaker after the second fault clearance. By use of a counting relay, lock-out can be arranged after a predetermined number of fault clearances (from one to 10) to warn the maintenance staff that the breaker should be inspected. An alarm relay is incorporated which provides warning when the need for this maintenance is imminent.

CATALOGUES AND LISTS

CEILINGS.—Catalogue dealing with the products of the company's Ceiling Division, including particulars of sections, panels, acoustic tiles, lighting fittings, etc., and showing typical installations.—**Courtney, Pope (Electrical), Ltd.,** Amhurst Park Works, Tottenham, London, N.15.

COMPRESSORS.—Booklet (CB.193) illustrating and describing a range of air compressors for industrial uses.—**B.E.N. Patents, Ltd.,** High Wycombe, Bucks.

ELECTRO-MAGNETIC VALVES. — Catalogue containing information on an extensive range of electro-magnetic valves.—**Londex, Ltd.,** Anerley Works, London, S.E.20.

INSTRUMENTS.—Copy of the Australian edition (F.25A/1) of the company's list of instruments for the control of temperature, pressure, humidity and flow, etc., and a catalogue (C.100) describing typical panels, cubicles and control rooms for which the company provides a service covering design, manufacture and installation.—**Negretti & Zambra, Ltd.,** 122, Regent Street, London, W.1.

Brochure describing an incremental inductance bridge.—**Furzehill Laboratories, Ltd.,** Watford, Herts.

International version of the company's catalogue of instrument cases, containing descriptions in ten languages.—**Alfred Imhof, Ltd.,** Ashley Works, Cowley Mill Road, Uxbridge.

LIGHTING FITTINGS.—Illustrated and priced 16-page catalogue covering industrial and commercial lighting fittings.—**Cryselco, Ltd.,** Kempston Works, Bedford.

Booklet of 14 pages discussing the functions of lamps and fittings in domestic lighting and giving details of prices of tungsten and fluorescent lighting equipment.—**Philips Electrical, Ltd.,** Century House, Shaftesbury Avenue, London, W.C.2.

Catalogue describing a range of lanterns and lighting controls for theatres, television studios, concert halls, etc.—**Strand Electric & Engineering Co., Ltd.,** 29, King Street, London, W.C.2.

PRESSURE SWITCHES. — Catalogue (119/J) dealing with the company's range of pressure switches and vacuum switches.—**Londex, Ltd.,** Anerley Works, London, S.E.20.

WIRING ACCESSORIES.—Catalogue (92 pages) illustrated in colour and describing the complete range of M.K. electrical accessories, including latest additions.—**M.K. Electric, Ltd.,** Shrubbery Road, London, N.9.

Illustrated catalogue giving particulars of the company's range of wiring accessories, cables and flexibles, etc.—**Ward & Goldstone, Ltd.,** Salford, 6, Manchester.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d *each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2*

1956

3211. Metropolitan-Vickers Electrical Co., Ltd.—Electrically operated hoist or window equipment. 18th January, 1957. (852902.)

7830. Siemens Edison Swan, Ltd.—Telephone systems. 11th March, 1957. (852892.)

8851. British Thomson-Houston Co., Ltd.—Protection of uranium. 21st March, 1957. (853302.)

9284. Hancock & Co. (Engineers), Ltd.—Photoelectric control devices. 21st March, 1957. (852893.)

10746. Siemens Edison Swan, Ltd.—Circuit arrangements for electronic flash discharge tubes. 1st April, 1957. (853303.)

12472. Plessey Co., Ltd.—Electrolytic capacitors. 12th April, 1957. (853106.)

12527. British Thomson-Houston Co., Ltd.—Winder plant control. 23rd April, 1957. (853107.)

16273. Metropolitan-Vickers Electrical Co., Ltd.—Pilot circuit protection. 22nd May, 1957. (853304.)

18953. English Electric Co., Ltd.—Transformer on-load tap changing means. 14th June, 1957. (853021.)

18999. Telephone Manufacturing Co., Ltd.—Electrical plug and socket connectors. 18th June, 1957. (853052.)

20751. Ericsson Telephones, Ltd.—Lamp signalling apparatus. 16th July, 1957. (853022.)

20925. National Research Development Corporation.—Variable energy linear particle accelerator. 5th July, 1957. (852809.)

22116. British Thomson-Houston Co., Ltd.—Rheostat. 12th July, 1957. (853023.)

24559. Mullard Radio Valve Co., Ltd.—Methods of manufacturing semiconductor devices. 10th August, 1956. (852904.)

25022. Southern Instruments, Ltd.—Machine for answering a telephone and for thereupon recording a message. 15th November, 1957. (853024.)

27767. Metropolitan-Vickers Electrical Co., Ltd.—Control of electric winder drives. 5th September, 1957. (853025.)

28265. Electric & Musical Industries, Ltd.—Binaural or stereophonic sound transmission systems. 13th September, 1957. (852810.)

31776. Thorn Electrical Industries, Ltd.—Control gear for electric discharge lamps. 15th October, 1957. (853026.)

33959. Nippon Telegraph & Telephone Public Corporation.—Circuit for automatic voltage regulating device. 7th November, 1956. (852906.)

34059. Geisler, W. S.—Linear electron accelerator. 7th November, 1956. (853053.)

1957

1164. Metropolitan-Vickers Electrical Co., Ltd.—High energy radiation method for production of cellular materials. 19th November, 1957. (853191.)

4407. Hirst Electronic, Ltd.—Saturable reactors. 31st January, 1958. (852821.)

4976. Standard Telephones & Cables, Ltd.—Electric discharge tubes. 13th February, 1957. (853058.)

5119. Sangamo Weston, Ltd.—Thermal convertors. 14th February, 1957. (853263.)

5328. Violet, M.—Device for the magnetic and electrical treatment of water and other materials. 15th February, 1957. (852733.)

6467. Siemens & Halske A.G.—Periodic magnetic focusing systems for electron beam tubes. 26th February, 1957. (853061.)

6948. A.E.I.-John Thompson Nuclear Energy Co., Ltd.—Nuclear reactors. 2nd June, 1958. (853269.)

7439. British Telecommunications Research, Ltd.—Electrical counting circuits. 4th March, 1958. (853270.)

7783. British Thomson-Houston Co., Ltd.—Semiconductor devices. 3rd March, 1958. (853029.)

10167. Telefunken G.m.b.H.—Turret switches. 28th March, 1957. (852916.)

10387. British Thomson-Houston Co., Ltd.—Enclosed spark gaps. 25th March, 1958. (853192.)

11567. British Telecommunications Research, Ltd.—Electrical signalling systems. 27th March, 1958. (852951.)

12528. General Electric Co., Ltd.—Ferroelectric data storage devices. 1[illegible]th July, 1958. (853193.)

13937. General Electric Co., Ltd.—Phosphors. 1st May, 1958. (852737.)

15792. Standard Telephones & Cables, Ltd.—Cold cathode switching devices. 17th May, 1957. (853286.)

19897. United Kingdom Atomic Energy Authority.—Cooling systems for nuclear reactors. 13th June, 1958. (852957.)

20186. General Electric Co., Ltd.—Automatic control systems. 26th June, 1958. (852742.)

23419. Foster Transformers, Ltd., and Jennings, R. E.—Electrical coil windings. 17th April, 1958. (852909.)

23598. Philips Electrical Industries, Ltd.—Frequency transformation devices. 25th July, 1957. (853149.)

24283. Lancashire Dynamo Electronic Products, Ltd.—Photo-electric detecting devices. 31st July, 1958. (853128.)

26992. General Electric Co., Ltd.—Electric modulators. 27th August, 1958. (852745.)

27895. E.M.P. Electric, Ltd.—High voltage electric fuses. 28th August, 1958. (853032.)

28419. British Telecommunications Research, Ltd.—Power feeding arrangements for telecommunication systems. 27th August, 1958. (853033.)

29785. Fernseh G.m.b.H.—Transistor circuits. 23rd September, 1957. (852746.)

30150. Atvidabergs Industrier A.B.—Electric control device for the control of electric voltage or current. 25th September, 1957. (853340.)

31390. Pownall, G. N. du T.—Electromagnetic devices for conveying or restraining rotary motion. 8th October, 1958. (853203.)

32246. United Kingdom Atomic Energy Authority.—Gas discharge apparatus. 9th October, 1958. (852897.)

32379. Allis-Chalmers Manufacturing Co.—Electric motor. 16th October, 1957. (853245.)

33423. Associated Electrical Industries, Ltd.—Formation of p-n junctions in semiconductor material. 25th October, 1957. (852749.)

35975. United Kingdom Atomic Energy Authority.—Radiation measuring equipment. 12th November, 1958. (853175.)

36028. I-T-E Circuit-Breaker Co.—Electrically insulating joint for isolated phase bus housings. 19th November, 1957. (853339.)

36991. Telefunken G.m.b.H.—Method for the manufacture of electronic discharge tubes provided with an oxide cathode. 27th November, 1957. (852750.)

37470. Mullard, Ltd.—Waveguide circulators. 15th August, 1958. (852751.)

37508. Soc. d'Electronique et d'Automatisme.—Amplifier circuit embodying a gas or vapour filled discharge tube. 2nd December, 1957. (853177.)

38060. Siemens Edison Swan, Ltd.—Moulding of electrically insulating blocks. 5th March, 1959. (853248.)

38061. Compagnie Française Thomson-Houston.—Fluid cooling of high power electron discharge tubes. 6th December, 1957. (Addition to 838105.) (853178.)

38227. British Thomson-Houston Co., Ltd.—Switching arrangement for series connected motors. 8th December, 1958. (853249.)

38836. General Electric Co., Ltd., and Puckette, C. C.—Telephone dials. 15th December, 1958. (852753.)

38837. General Electric Co., Ltd., and Simon-Carves, Ltd.—Support structures. 28th November, 1958. (852839.) 38839. Nuclear reactors. 28th November, 1958. (852840.)

39061 Metropolitan-Vickers Electrical Co., Ltd.—Electron emitters. 9th December, 1958. (853352.)

1958

3808. Bassani S.p.a.—Electric snap-action switches. 5th February, 1958. (853040.)

3889. Tanaka, K.—Fluorescent lamp starting circuits. 6th February, 1958. (853131.)

5376. United Kingdom Atomic Energy Authority.—Thermocouple arrangements. 29th January, 1959. (852782.)

7415. General Electric Co., Ltd.—Chokes. 6th March, 1959. (853345.)

5472. Loye, W.—Control systems for electrically heated blankets or warming pads. 9th February, 1959. (853213.)

5859. Limit Engineering Group, Ltd., and Collins, A. L.—Speed government for electric motors. 3rd October, 1958. (Cognate application 18737, 11th June, 1958.) (853135.)

5904. Geloso, G.—Telephone interconnection systems. 24th February, 1958. (852774.)

7834. Licentia Patent-Verwaltungs-G.m.b.H.—Electric washing machine. 11th March, 1958. (853346.)

8659. Brown, Boveri & Cie. A.G.—Dynamo-electric machines with supports for the coil ends of two-layer d.c. coil windings. 18th March, 1958. (853251.)

10116. Morgan Crucible Co., Ltd.—Electrical resistors. 25th March, 1959. (852934.)

10149. Marconi's Wireless Telegraph Co., Ltd.—Frequency dividers. 5th December, 1958. (853252.)

14694. Garratt, W. J.—Electric junction and like boxes. 8th May, 1959. (853140.)

15354 Telefunken G.m.b.H.—Electron guns. 13th May, 1958. (852781.)

15194. Sunbeam Corporation.—Composite electrically heated devices and method of making same. 12th May, 1958. (852780.)

15456. Westinghouse Electric Corporation.—Invertor circuits. 14th May, 1958. (853277.)

15651/2. Mullard, Ltd.—Manufacture of electron discharge tubes having a photo-conductive target. 24th November and 11th December, 1958. (853101 and 853070.)

15793. Standard Telephones & Cables, Ltd.—Dry plate rectifier assemblies. 16th May, 1958. (852937.) 15802. Magnetic cores. 15th May, 1959. (853071.)

16337. Ultra Electronics, Ltd.—Mechanico-electrical transducers. 17th April, 1959. (853329.)

16668 Electronic Tubes, Ltd.—Electron guns. 6th August, 1959. (852759.)

16674. Wilcolator Co.—Electric switch mechanism and contact arrangements therefor. 23rd May, 1958. (852760.) 18007. Electrical switching unit. 5th June, 1958. (852762.)

16684. Ferguson Pailin, Ltd.—Air or gas blast electric switches or circuit-breakers. 8th May, 1959. (852761.)

17032. Derby Luminescents, Ltd.—Phosphors. 27th July, 1959. (853006.)

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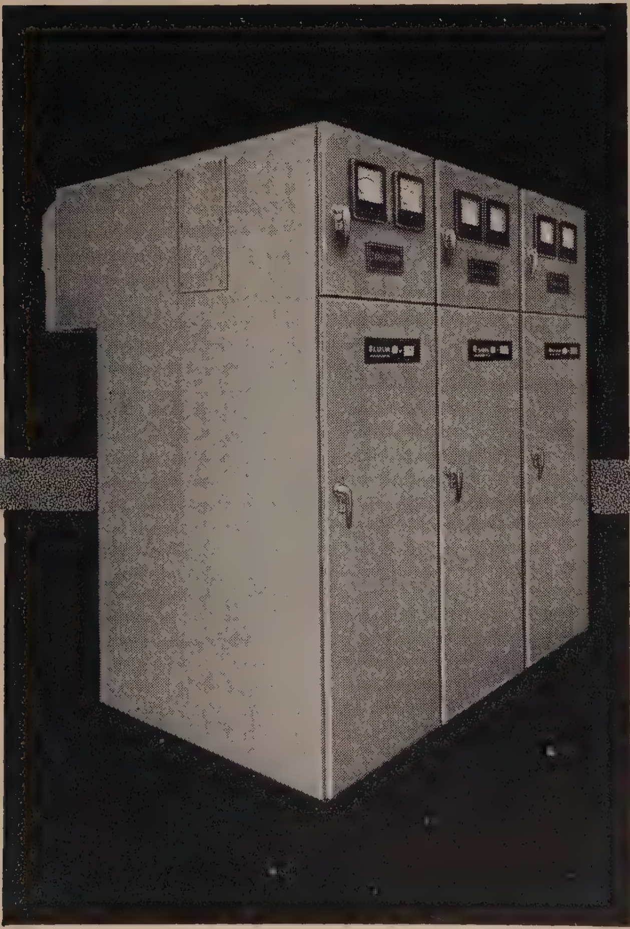

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3·3 kV	150 M V A
6·6 kV	250 M V A
11 kV	250 M V A
11 kV	350 M V A

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 28th NOVEMBER

Arborfield.—Unit Cinema, 3 (Tels.) Training Bn., R.E.M.E., 7 p.m. I.E.E. London Graduate and Student Section, Arborfield District. Film evening.

Birmingham.—James Watt Memorial Institute, 6 p.m. I.E.E. South Midlands Electronics and Measurement Group. "Static Switching," by G. L. Butcher.

Regent House, St. Philip's Place, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. "Production of Light Sources," by H. R. Ruff.

Bristol.—Electricity House, Colston Avenue, 6 p.m. I.E.E. Western Centre. "Discrimination between H.R.C. Fuses," by E. Jacks.

Crewe.—Mechanics' Institute, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Survey of Street Lighting and its Future," by W. R. Stephens and H. M. Ferguson.

Ipswich.—Electric House, 6 for 6.30 p.m. I.E.E. East Anglian Sub-Centre. "An Introduction to Electronic Computers," by R. C. M. Barnes.

Liverpool.—Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Thermistors—Their Theory, Manufacture and Application," by Dr. R. W. A. Scarr and R. A. Setterington.

M.A.N.W.E.B. Centre, Paradise Street, 7 p.m. I.E.E. Mersey and North Wales Graduate and Student Section. "Power from the Atom—by Fission and Fusion," by K. W. Huddart.

London.—Savoy Place, W.C.2, 6 p.m. I.E.E. Education Discussion Circle. "Training for Research." To be opened by Professor G. H. Rawcliffe.

Sheffield.—Grand Hotel, Grosvenor Room, 6.30 p.m. Institution of Production Engineers, East and West Ridings Region. "Membership Qualifications," by H. W. Hodson.

Watford.—Compass Hotel, 7.45 p.m. A.S.E.E. North West London Branch. "Electrical Aspects of Process Control," by W. C. Hankins.

TUESDAY, 29th NOVEMBER

London.—26, Portland Place, W.1, 6.30 for 7 p.m. Society of Instrument Technology, London Meeting. Symposium on Nuclear Temperature Scanning. "Temperature Scanning Equipment for a Large Nuclear Reactor," by C. Hall, and "Temperature Scanning Equipment for Use in a Nuclear Power Station," by A. G. Blay, P. G. Davey and F. C. Flint.

TUESDAY, 29th NOVEMBER to FRIDAY, 2nd DECEMBER

London.—Olympia. Corrosion and Metal Finishing Exhibition.

WEDNESDAY, 30th NOVEMBER

Kingston.—C.E.G.B. Kingston "B" Generating Station, 10.30 a.m. I.E.E. London Graduate and Student Section. Visit.

London.—1, Birdcage Walk, Westminster, S.W.1, 6 p.m. Institution of Mechanical Engineers. "Economic Results of Diesel-Electric Motive Power on the Railways in the United States of America," by H. F. Brown.

Connaught Rooms, W.C.2, 12.30 for 12.55 p.m. Batti-Wallahs' Society. Luncheon.

Bonnington Hotel, Southampton Row, W.C.2, 6.30 p.m. Institute of Electricity Administration. "Publicity and Display," by G. Bowen-Jones.

Savoy Place, W.C.2, 5.30 p.m. I.E.E. London Meeting. Electronics and Communications Section. "The Potentialities of Artificial Earth Satellites for Radiocommunication," by W. J. Bray.

Rugby.—College of Engineering Technology, 6.30 p.m. I.E.E. Rugby Sub-Centre and Rugby Graduate and Student Section. "Electricity in Medicine," by W. J. Perkins.

Sheffield.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre and Graduate and Student Section. Discussion. "The Education and Training of a Professional Electrical Engineer."

WEDNESDAY, 30th NOVEMBER to FRIDAY, 2nd DECEMBER

London.—Hoare Memorial Hall, Church House, Great Smith Street, S.W.1. Iron and Steel Institute. Svmposium on "Steels for Reactor Pressure Circuits."

THURSDAY, 1st DECEMBER

Cardiff.—I.E.S. Cardiff Centre. "Lamp Progress and its Application to Modern Lighting Installation."

Harwell.—Cockcroft Hall, 5.45 p.m. A.S.E.E. Oxford and District Branch. "Circuit and Equipment Applications of Transistors."

Hove.—New Imperial Hotel, 1st Avenue, 7.30 p.m. A.S.E.E. Brighton, Hove and District Branch. "Stage Lighting Presentation," by F. E. Brown.

Hull.—Y.E.B. Offices, Ferensway, 6.30 p.m. I.E.E. North Midland Centre. "Marine Electrical Practice on Cargo Liners," by D. G. Robinson. (Joint meeting with Hull District.)

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Ordinary Meeting. "Our Civic Lighting: Gloom or Gaiety," by W. R. Stevens and H. M. Ferguson.

Manchester.—Reynolds Hall, College of Technology, 7 p.m. British Institution of Radio Engineers, North Western Section. "Industrial Television," by I. M. Waters.

Nottingham.—Electricity Centre, Carrington Street, 6 p.m. I.E.S. Nottingham Centre. "The Eye and Artificial Lighting," by W. J. Wellwood Ferguson.

FRIDAY, 2nd DECEMBER

Birmingham.—Golden Eagle Hotel. A.S.E.E. Birmingham Branch. Christmas dance.

Cardiff.—Grand Hotel. A.S.E.E. South Wales Branch. Annual dinner.

Cheltenham.—North Gloucestershire Technical College, 7 p.m. British Institution of Radio Engineers, South Midlands Section. "The Place of the Electric Rocket in Space Propulsion," by W. A. S. Murray.

Crewe.—Royal Hotel, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. "Variable Speed A.C. Motors," by J. C. H. Hone.

Liverpool.—M.A.N.W.E.B., Paradise Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. "An Approach to the Use of Electrical Units," by D. Chalmers.

London.—Grosvenor House, Park Lane, W.1. Institute of Marine Engineers. Annual conversazione.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers, Computer Group. "Progress in Microminiature Circuit Techniques for Digital Computers," by D. Roberts and P. M. Thompson.

Savoy Place, W.C.2, 6 p.m. I.E.E. Medical Electronics Discussion Group. Discussion on "Telemetering Biological Data," opened by G. H. Byford and Dr. K. G. Williams.

14, Rochester Row, S.W.1, 7 p.m. Junior Institution of Engineers. Film evening.

Newcastle-upon-Tyne. — Crown Hotel, Clayton Street. A.S.E.E. Newcastle-upon-Tyne and District Branch. Annual pie supper.

SATURDAY, 3rd DECEMBER

Kidlington.—Red Lion. A.S.E.E. Branch dinner.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 16th December:—

Anoware Rinse-N-Dry. No. 798,625. Class 7. Centrifugal rinsing and drying machines. —Ellvin & Co., Ltd., 17, Willow Lane, Mitcham, Surrey.

Drytime. No. 799,084. Class 7. Domestic tumbler drying machines. No. 799,085. Class 11. Drying cabinets and drying installations. —Wallisdown Electrical Appliances, Ltd., Wallisdown Road, Winton, Bournemouth.

Keymatic. No. 799,408. Class 7. Domestic machines included in Class 7 and electric motors (not for land vehicles).—Hoover, Ltd., Perivale, Greenford, Middx.

Swirlator. No. 802,722. Class 7. Machines for washing and drying.—General Steel Wares, Ltd., Toronto. Address for service: Raworth, Moss & Cook, 38, Sydenham Road, Croydon.

Remington. No. 788,892. Class 7. Electric shaving instruments and parts.—Remington Rand, Ltd., Commonwealth House, 1-19, New Oxford Street, London, W.C.1.

Bailey Meters. No. 777,631. **Bailey.** No. 782,871. Class 9. Apparatus automatically operated by changes in physical variables for giving visible and/or audible warning of failure in industrial operations and for automatically controlling such operations; voltage regulators; switches, etc.—Bailey Meters & Controls, Ltd., Purley Way, Croydon.

AF (in design). No. B792,283/4. Classes 9 and 11. Electrical apparatus, instruments and parts.—Société de l'Accumulateur Fulmen, Clichy, France. Address for service: Marks & Clerk, 57/8, Lincoln's Inn Fields, London, W.C.2.

Tungsram. No. 793,833. Class 9. Scientific and electrical apparatus; insulated wire, cables and conduits; telecommunication apparatus; electric cells; electric discharge tubes (not for lighting); ultra-violet and infra-red ray apparatus; arc welding apparatus and electrodes, etc., but not including semiconducting devices or thermionic valves for use in telegraphy or telephony.—Egyesult, Izzólámpa és Villamossági Részvenytársaság, Budapest. Address for service: W. P. Thompson & Co., 12, Church Street, Liverpool.

Clartone. No. 801,155. Class 9. Sound transmitting and receiving apparatus.—Clairtone Sound Corporation, Ltd., Toronto. Address for service: Eric Potter & Clarkson, 317, High Holborn, London, W.C.1.

CTS (in design including crown). No. 799,498. Class 9. Resistors, potentiometers, rheostats, switches, etc.—CTS Corporation, Elkhart, Indiana, U.S.A. Address for service: Mathys & Squire, Staple House, 52, Chancery Lane, London, W.C.2.

Autochef. No. B800,221. Class 9. Control apparatus for automatically maintaining predetermined temperatures in cooking appliances.—British Thermostat Co., Ltd., Teddington Works, Windmill Road, Sunbury-on-Thames.

Zetamatic. No. 796,804. All goods in Class 11. — Longford Electric Co., Ltd., 6, Grosvenor Street, Manchester.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—State Electricity Commission of Western Australia. Proposed 120 MW power station near the Muja open-cut coal site at Collie. (E.S.B. 29393/60.)*

Bolivia.—Santa Cruz Public Works Committee. 7th January. 5 MW power plant for city. The successful tenderer will subsequently be required to study the possibility of hydro-electric development in the area. (E.S.B. 29400/60.)*

Burma.—Board of Management, Port of Rangoon. 21st December. Three 500 kVA transformers, cable, jointing materials and lighting fittings. (E.S.B. 30016/60.)*

Canada. — Winnipeg Hydro-Electric System. 7th December. Supervisory control equipment. (E.S.B. 30085/60.)*

Ceylon.—Ministry of Agriculture, Land Irrigation and Power. 10th January. Sixteen 1.1 kV metering units and six sets of metering equipment for 33 kV overhead line systems. (E.S.B. 29442/60.)*

Durham.—County Council. 7th December. Extensions to electrical installation at Ryton Modern School. (See this issue.)

Egypt.—Ministry of Public Works. 23rd January. Erection of 66 kV lines for fourth extension of Delta scheme. (E.S.B. 29449/60.)*

Formosa.—Central Trust of China. 6th December. 48,000 fuse links. (E.S.B. 30006/60/I.C.A.)* 17th December. 42 metric tons of zinc-coated steel overhead earth wire. (E.S.B. 30080/60/I.C.A.)* 19th December. Cable and accessories. (E.S.B. 30443/60/I.C.A.)*

Grimsby.—R.D.C. 6th December. Group "A" street lighting. (See this issue.)

Heston and Isleworth.—Corporation. 8th December. Street lighting improvements. (See this issue.)

India.—Punjab State Electricity Board. 12th December. 14,500 three-phase electricity meters. (E.S.B. 29462/60.)* 19th December. 2,120 time switches. (E.S.B. 29466/60.)* 26th December. Forty-seven 11 kV multi-panel switchboards. (E.S.B. 29467/60.)* 5th January. Electrical instruments. (E.S.B. 29469/60.)*

Irish Republic.—Waterford County Council. 14th December. Two electric pumping sets. (E.S.B. 29441/60.)*

Korea.—Government Office of Supply. 13th December. Sixteen diesel-engine generators, 5-250 kVA, and telecommunications equipment. (E.S.B. 30097/60/I.C.A.)* 15th December. Electronic instruments. (E.S.B. 30423/60/I.C.A.)* 13th December. Power cable, electrical equipment, etc. (E.S.B. 30421/60/I.C.A.)* 20th December. Equipment including 30 kV diesel-electric set. (E.S.B. 30422/60/I.C.A.)*

London.—Wandsworth Borough Council. 16th December. Electric lamps, metal filament and electric discharge (Form h.), and electrical works (Form i.), for a three-year period from 1st April, 1961. Borough engineer, Municipal Buildings, S.W.18.

Pakistan.—Director of Supply, East Pakistan. 8th December. H.v. and l.v. switchgear. (E.S.B. 29397/60.)*

Directorate General, Posts and Telegraphs. 15th December. Air conditioning equipment for new radio receiving station, Karachi. (E.S.B. 30037/60.)*

Portuguese East Africa.—Department of Posts, Telegraphs and Telephones of Mozambique. 1st February. Multi-channel scatter radio link. (E.S.B. 29453/60.)*

Rhodesia and Nyasaland.—Town Clerk, Bulawayo. 7th December. Insulated cables and bare copper conductor. (E.S.B. 30046/60.)* 14th December. Six 200 kVA, 11,000/400 V outdoor transformers. (E.S.B. 30047/60.)*

Bulawayo Electricity Department. 6th December. Earth resistance testers. (E.S.B. 30483/60.)* 14th December. Miniature circuit-breakers. (E.S.B. 30484/60.)*

South Vietnam. — Central Purchasing Authority. 21st December. 60 kW generator. (E.S.B. 30524/60/I.C.A.)*

Sudan.—Sudan Railways. 26th December. Street lighting fittings. (E.S.B. 29438/60.)*

United States.—Bureau of Reclamation, Denver, Colorado. 5th December. Disconnecting switches and fuses. (E.S.B. 29440/60.)*

Public Utility District No. 1, Chelan County, Wenatchee, Washington. A.c. network analyser. (E.S.B. 30414/60.)*

West Lothian.—County Council. 19th December. Trunk road junction lighting. (See this issue.)

ORDERS PLACED

Durham.—County Education Committee. Electrical work at schools:—Birtley Ravensworth Terrace County School (£1,104).—T. Mitchelson (Electrical). Billingham Campus School (£34,585).—C. Horne & Co. Durham Technical College (£2,083).—North of England Engineering & Electrical Co.

Newcastle-on-Tyne.—Regional Hospital Board. Electrical work in X-ray department at Hemlington Hospital, Middlesbrough (£2,265).—H. G. Sproates. Electrical work for two extension schemes at Prudhoe and Monkton Hospital (£7,805 and £12,488).—James Scott & Co. Electrical work at nurses' training centre, West Cumberland Hospital (£2,633).—G. H. Bowman & Son.

Stockton-on-Tees.—Corporation. Electrical installation in the Hardwick shopping centre (£2,042).—Williams Brothers.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Acton.—Clinic and child guidance centre, Avenue Road (£35,425) and extensions to Bromyard Secondary School (£191,569); county architect, 1, Queen Anne's Gate Buildings, S.W.1.

Amble.—Houses and bungalows (38), Links estate; U.D.C. surveyor.

Bracknell.—Works extensions; Premier Precision, Ltd., Western Road.

Bradford.—South Bradford Secondary School; W. Zinn & Associates, architects, Collingham House, Eagle Street, London, W.C.1.

Durham.—Modern school at Wingate; R. Brown, architect, 123, Victoria Road, Darlington

Primary school, High Coniscliffe; Clayton & Deas, architects, High Row Chambers, Darlington.

Eccles.—Adult training centre, Chorlton Fold; county architect, County Offices, Preston.

Epsom.—Erection of Longmead County Secondary Boys' School (£261,900); county architect, County Hall, Kingston-on-Thames.

Godmanchester.—Children's home (1961-62 programme); county architect, Huntingdon.

Haverhill.—Factory and offices; J. C. Myers, architect, High Street, Haverhill, Suffolk.

Huntingdon.—Health clinic, Nursery Road; county architect, Huntingdon.

Ilfracombe.—Two-storey bus station, Ropery Road; Southern National Omnibus Co., Ltd., 48, Queen Street, Exeter.

Ipswich.—Home for aged people, Chantry estate; borough engineer, 19, Tower Street.

Jarrow.—Nine-storey blocks of flats, Market Place; H. W. T. Perkins, borough engineer.

Leicestershire.—New County Council offices at Anstey during 1961-62; county architect, Leicester.

Louth.—Junior training centre and hostel for sub-normal children (£44,800); county architect, Lincoln.

Malling.—Dwellings (116), Ditton Park, Ditton; surveyor, Council Offices, West Malling, Kent.

Manchester.—Factory for A. Levine, Ltd.; John Finlan, Ltd., Hale Bank, Widnes.

Middleton.—Major extension, De Salle Teachers' Training College; Reynolds & Scott, architects, 9, Albert Square, Manchester.

Oxford.—Bus station, Rowley Road; Thames Traction Co., Ltd., 35, Frogmore, High Wycombe.

Salop.—Additions to Walford Hall Farm Institute (£84,300); county architect, London Road, Shrewsbury.

Settle.—Houses (54), High Bentham; J. Norman Spencer, architect to R.D.C., Piccadilly, Bradford.

Spennymoor (Co. Durham).—Factory, Spennymoor trading estate, for the Industrial Estates Management Corporation; Fennell & Baddiley, architects, Bridge End Chambers, Chester-le-Street.

Stockton-on-Tees.—Office block, warehouse, etc.; J. W. Towers & Co., Ltd., 28, Bridge Road.

Old people's hostel, Redhill Road; county architect, South Street, Durham.

Sports stadium (£250,000); borough engineer.

Sunderland.—Houses (550), Town End Farm estate; borough architect, Grange House, Stockton Road.

Swansea.—Works, Crymlyn Burrows; B.P. Refinery, Ltd., Llandarcy, Neath.

Walsall.—Works, Willenhall Lane, Bloxwich; Ashvic Engineering Co., Ltd., 61, Frederick Street.

Wellington.—Extensions and alterations to Wellington Grammar School (£112,960); county architect, London Road Offices, Shrewsbury.

Weymouth.—New buildings for the Weymouth Grammar School (£220,000); F. Denley & Partners, quantity surveyors, 45, Commercial Road, Parkstone.

Whitstable.—Factory, Thaney Way; Riverside Press, New Road, Gravesend.

Willesden.—New out-patients', casualty and X-ray departments at Willesden General Hospital (£148,000); regional architect, 40, Eastbourne Terrace, London, W.2.

Wood Green.—Five-storey blocks of flats and two-storey block of elderly persons' flats, Edith Road area; borough engineer, Town Hall, N.22.

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* This information is extracted from the Board of Trade *Export Service Bulletin.* Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.

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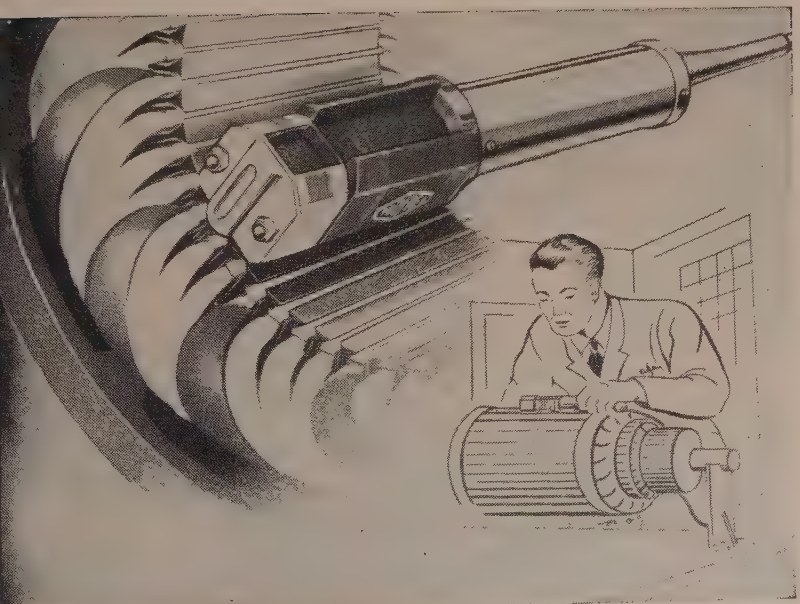

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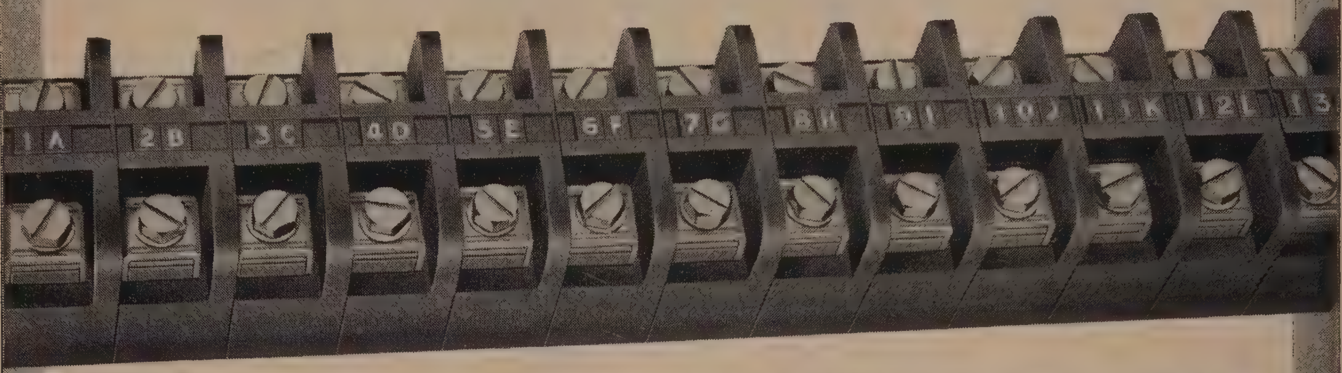

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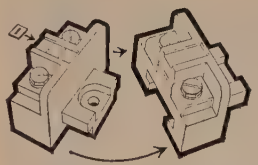

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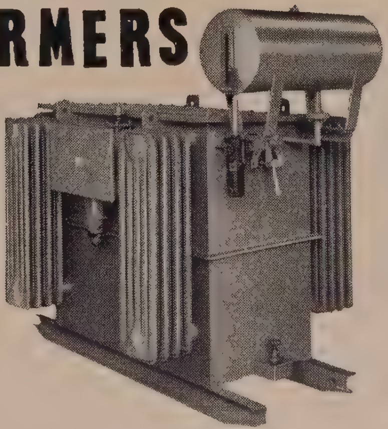

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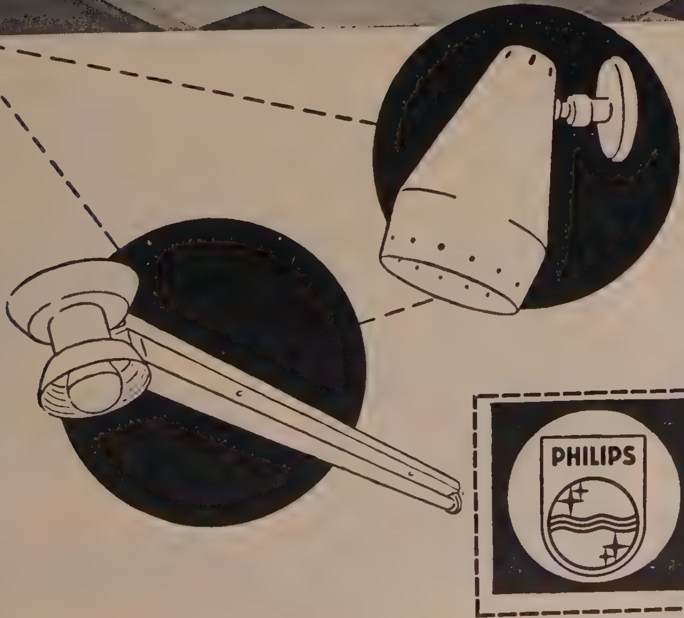

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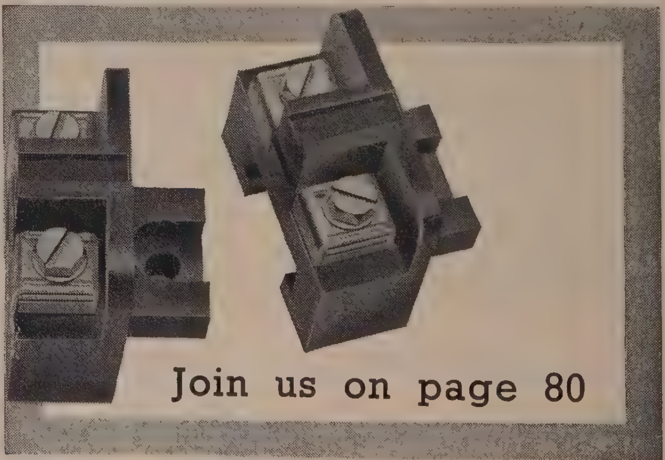

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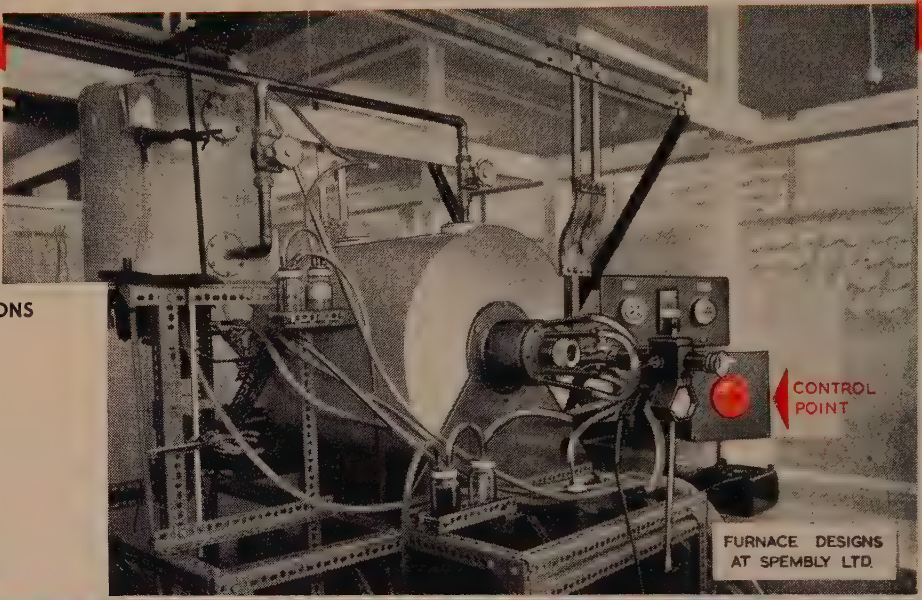

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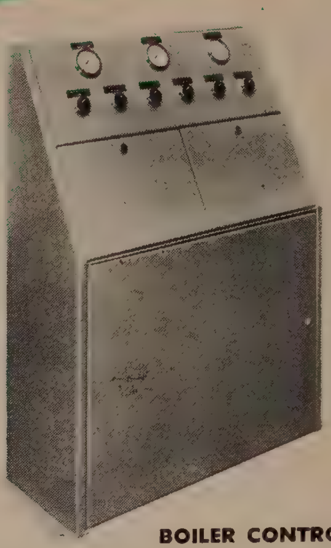

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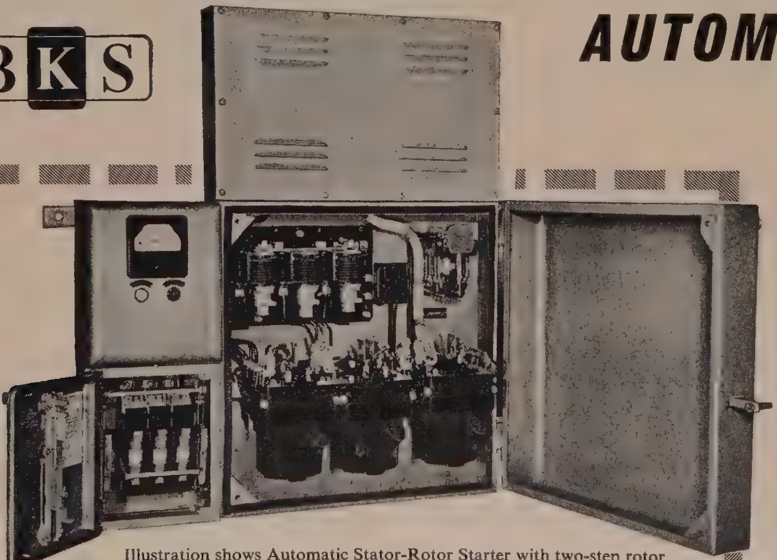

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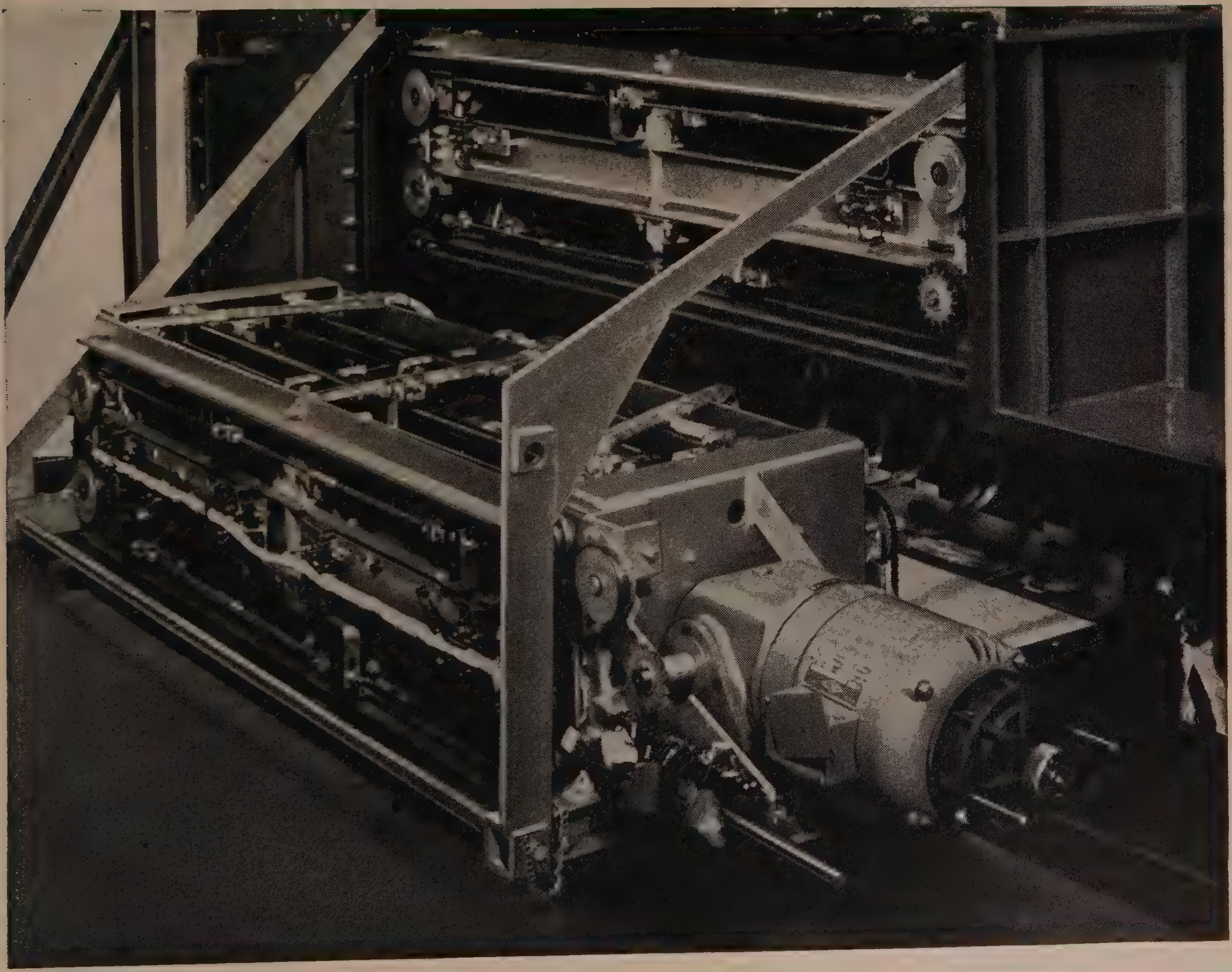

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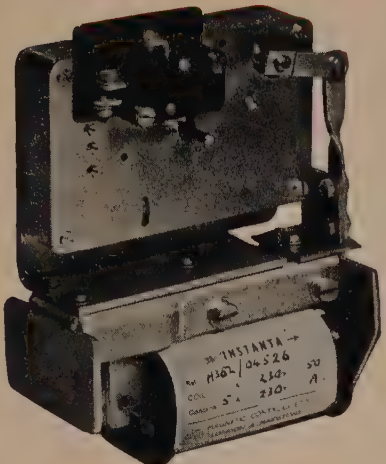
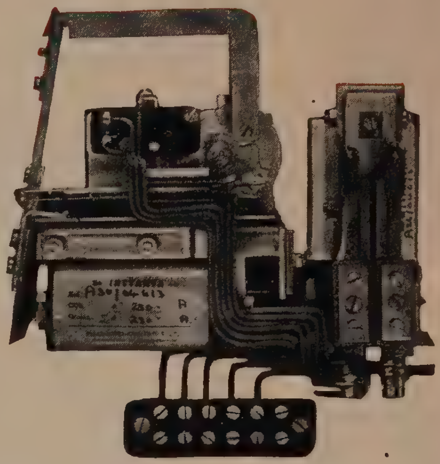


Type R.103
Ranges: 0/1, 0/10, 0/30, 0/60, 0/120 and
0/300 seconds



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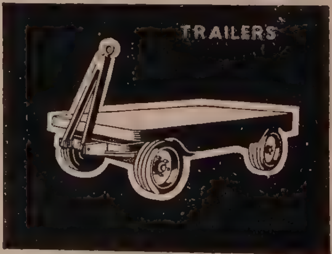

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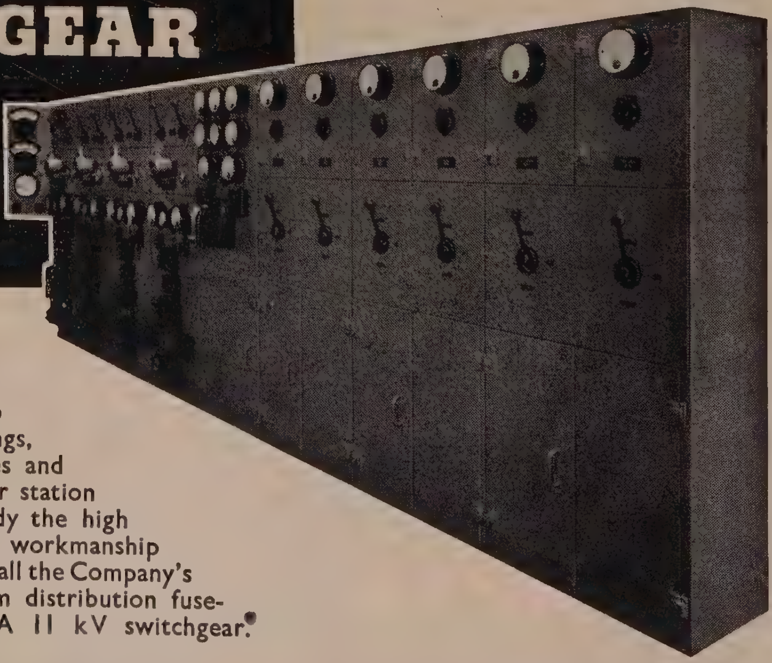

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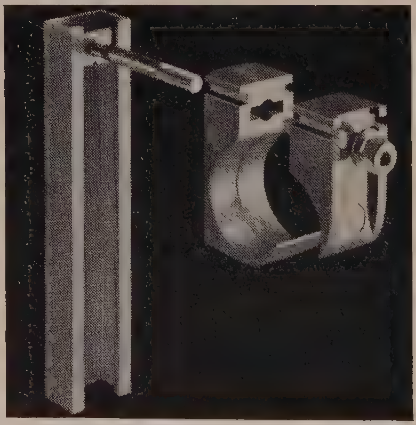

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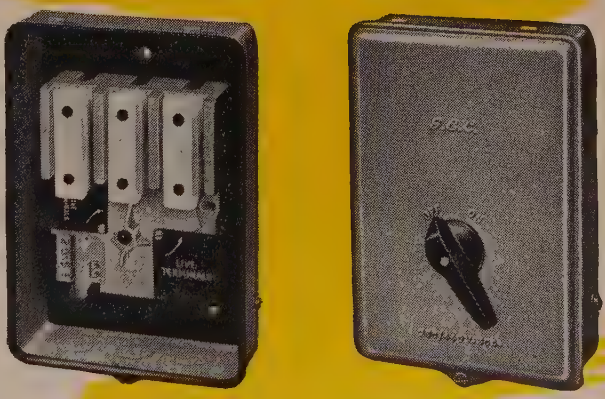

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ELECTRICAL INSTALLATION CONTRACTORS

JAMES SCOTT & CO. (ELECTRICAL ENGINEERS) LTD.
Argyle House, Argyle Street, Newcastle-upon-Tyne 1
Telephone 28605
Britain's Largest Electrical Installation Organisation for all high-class Electrical Installation and Instrumentation

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
52 Elswick Road, Newcastle
Telephone: Newcastle 36271

SOUTH WEST SCOTLAND

JAMES SCOTT & CO. (ELECTRICAL ENGINEERS) LTD.

80/110 Finnieston Street Glasgow, C.3	21/25 George IV Bridge Edinburgh
Telephone: Central 3866	*Telephone: Central 6424*

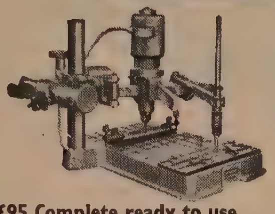
Britain's Largest Electrical Installation Organisation for all high-class Electrical Installation and Instrumentation

REPUBLIC OF IRELAND

Electrical Engineering Contractors
A. G. BRUTY LIMITED
38 Dawson Street, Dublin
Telephone: Dublin 73181

Applications for particulars of costs and standard style of advertisements in this Regional Guide should be addressed to:
THE
ADVERTISEMENT DEPARTMENT,
ELECTRICAL REVIEW,
DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

ENGRAVING
as easy as ABC



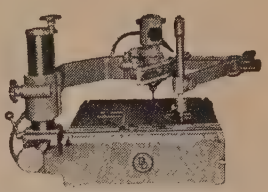
MODEL 848 ENGRAVING MACHINE

Reduction range 1 : 2 to 1 : 4. Vertical adjustment to suit workpiece height. Area for 1 : 2 reduction 5in. by 3in., for 1 : 4 reduction, $2\frac{1}{4}$in. by $1\frac{1}{4}$in.

£95 Complete ready to use

MODEL 713 ENGRAVING MACHINE

Reduction range 1 : 2 to 1 : 8, with engraving at near writing speeds. Balanced pantograph has ball pivots and adjustable tension. Area for 1 : 2 reduction, 15in. by 10in., for 1 : 8 reduction, 15in. by 4in.



£175 Complete ready to use

Ideal for ELECTRICAL NAME PLATES AND PANELS

Write for full details of our range of ENGRAVING EQUIPMENT to:

DAVID DOWLING LIMITED
HAROLD WOOD · ROMFORD · ESSEX · Tel.: Ingrebourne 43904

Automatic Data Recording Components

PUSH BUTTON UNITS

Features:-

These robust strips provide 10 keys normally 0-9 and a key marked C for cancelling. Built-in solonoid of 250 ohms enables remote tripping from a 50 v. D.C. source. Captions can be engraved on the keys in place of numbers. Up to 4 sets of change over contacts may be fitted utilizing 'type 600' spring sets on unit 'A'. A mechanical interlock prevents any two buttons being depressed.

A dust proof gasket is also provided.

Type MA Type A

WE ALSO MAKE UP TO **8 UNIT REPERFORATORS**
8-WIRE TAPE READERS

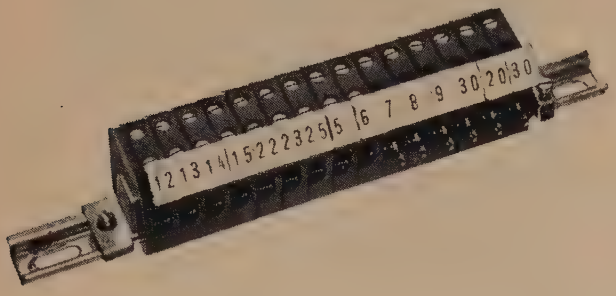
and ELECTRO MECHANICAL COUNTER FOR ENCODING PURPOSES
ALSO TAPE WINDER FOR PERFORATED STRIP

WELMEC CORPORATION LIMITED

Manufacturing and Developments Division

29 Cowcross Street, London, E.C.1 *CLErkenwell 0903-6783*

25-100 AMP. TERMINAL TYPE C.G.T. FOR CONTROL AND LOAD CIRCUITS

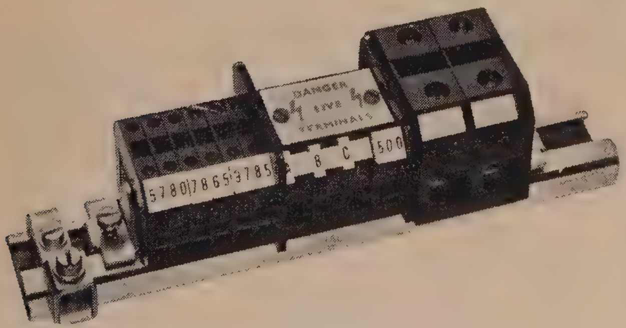


- Snap-in fixing, no special tools required
- High-grade Melamine mouldings for first-class insulation
- Special cable clamp to eliminate strand breakage
- Terminal identification simply achieved

OBERTERM
ELECTRICAL CO. LTD.

ALL BRITISH
CONTROL GEAR TERMINALS

0-25 AMP. TERMINAL TYPE M.T. FOR CONTROL AND INSTRUMENT CIRCUITS



- Space saving — 100 ways per 30 inches
- Available with screw and solder connections

Above are only some of the many advantages that OBERTERM clip-in terminals offer

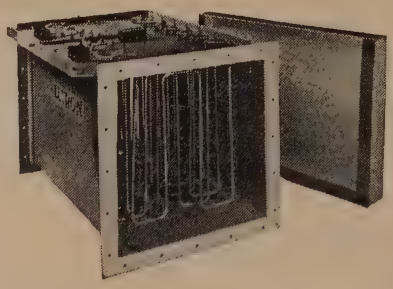
WRITE FOR FURTHER DETAILS TO:

TERMINAL WORKS, KIMBOLTON ROAD
HIGHAM FERRERS, NORTHANTS
Tel.: RUSHDEN 3677

LONDON OFFICE: 80 New Bond Street, W.1. *Tel.: Hyde Park 0728*

ELTRON for ELEMENTS

AIR DUCT HEATING UNIT



COMPETITIVE PRICES

● **QUICK DELIVERIES** ●

***Special* ELEMENTS**
for AIR, OIL and WATER

Eltron (London) Ltd., Strathmore Road, Croydon
Telephone: Thornton Heath 1861

'Stewart'
TRANSFORMERS

Suitable for any Equipment where loadings up to 250 KVA (double wound) **are required**

VOLTAGES UP TO 66 KV

CURRENT UP TO 2500 amp.

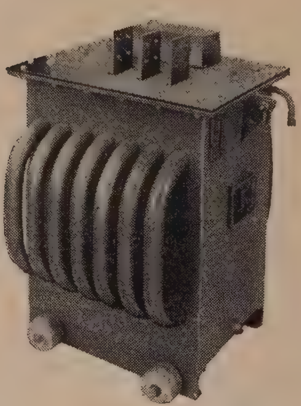


Illustration shows a 2500 amp. 3 phase Plating Transformer

For . . .
ELECTRO-PLATING
RECTIFIER EQUIPMENT
FURNACES—
EVERY INDUSTRIAL APPLICATION

STEWART TRANSFORMERS LTD.
Kilburn Lane, London, W.10 Tel: LADbroke 2296/7

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words).

DISPLAYED CLASSIFIED:—48/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

Advertisements are accepted up to **first post on Monday** of the week of issue

If blocks, bold type or ruled borders are required then on **Friday** prior to week of issue

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

BOROUGH OF HESTON AND ISLEWORTH

Street Lighting Improvement, Vicarage Farm Road, Hounslow (H.O.2)

TENDERS are invited for the installation of Street Lighting to Group A standard in Vicarage Farm Road, Hounslow, from Bath Road, Hounslow, to New Heston Road, Heston. The work includes the removal of 28 existing columns and the supply and erection of 41 steel columns with mercury fluorescent (colour corrected) lamps, lanterns and control gear.

On deposit of £2 2s. (returnable if a bona fide tender is received and not withdrawn) the bill of quantities, specification and form of tender may be obtained from, and the conditions of contract and drawings seen at, the Borough Engineer's Department, 88, Lampton Road, Hounslow. Tenders, in enclosed envelopes supplied but not indicating the tenderer, must be delivered to me by 10 a.m. on 8th December, 1960. The Corporation are not bound to accept any tender.

D. MATHIESON,
Town Clerk.
Town Hall,
Hounslow, Middlesex.
6814

WEST LOTHIAN COUNTY COUNCIL

Junction Lighting:
Trunk Road A.8, Starlaw Junction (A.8/A.89)
Broxburn Junction (A.8/899)

TENDERS are invited for the supply and erection of 25 200-watt "Long" type enclosed non-cut-off enclosed side entry, and 6 200-watt "Long" type enclosed cut-off side entry Sodium Lanterns, mounted at 35 ft. on tubular steel columns having an outreach of 10 ft. 6 in., on the above Trunk Road.

Copies of the specification, bill of quantities and form of tender may be obtained from the County Electrical Manager, 212, High Street, Linlithgow, West Lothian, where plans of the proposed scheme may be inspected.

Tenders in plain sealed envelopes, endorsed "Tender for Junction Lighting A.8," to reach County Electrical Manager, 212, High Street, Linlithgow, on or before noon of Monday, 19th December, 1960. The Council do not bind themselves to accept the lowest or any tender.

JOHN CALDER,
County Clerk.
County Buildings,
Linlithgow.
15th November, 1960.
6852

GRIMSBY RURAL DISTRICT COUNCIL

Parish of Waltham

Group "A" Street Lighting

TENDERS are invited for the supply and erection of 14 Precast Concrete Street Lighting Columns, 25 ft. mounting height, Lanterns, Control Equipment, etc., on Louth Road (Trunk Road A.16), Waltham.

Specification, bills of quantities and plans may be obtained from the Council's Surveyor, 1, Deansgate Terrace, Grimsby, on payment of a deposit of two guineas, returnable on receipt of a bona fide tender.

Tenders, sealed in the envelopes provided, are to be returned to the undersigned not later than noon on Tuesday, 6th December, 1960.

F. WILSON,
Clerk of the Council..
Council Offices,
Deansgate,
Grimsby, Lincs.
6854

DURHAM COUNTY COUNCIL

TENDERS invited:—

Ryton Modern School: Extensions and Adaptations—Electrical Installation.

Application for further details to County Architect, South Street, Durham, not later than 7th December, 1960.

J. K. HOPE,
Clerk of the County Council.
Shire Hall,
Durham.
6855

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER
(Drawing Office),
BELVEDERE POWER STATION
(Vacancy No. 60/948).

Minimum technical qualification O.N.C. level, general drawing office duty in large modern power station. Salary Class L, Grade 14 = £940-£1,065 per annum.

Applications, quoting vacancy number, to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 6th December, 1960. 6831

PAKISTAN

AN expanding firm of electrical manufacturers of motors (up to 30 h.p.), transformers (5/1.600 kVA) and switchgear (11 kV) urgently requires to fill the following appointments in the Punjab:—

WORKS MANAGER

ASSISTANT WORKS MANAGER

CHIEF TRANSFORMER DESIGNER

Candidates should be Corporate Members of the Institution of Electrical Engineers or have an equivalent qualification, and for the managerial positions have experience of production, design and planning. It is essential to have had experience in the manufacture of motors, transformers and switchgear.

Age 35-50; salary £1,800-£2,500, inclusive of allowances; contracts initially for 3 years.

Send full particulars to:—

The Registrar
PROFESSIONAL ENGINEERS APPOINTMENTS BOARD
201, High Holborn, London, W.C.1
6810

UNIVERSITY OF SYDNEY

APPLICATIONS are invited for the following positions in the Department of Electrical Engineering:—

1. LECTURESHIP/
SENIOR LECTURESHIP
IN ELECTRICAL ENGINEERING.

Candidates should have good academic qualifications in Electrical Engineering, experience in some aspect of power engineering, and a working knowledge of electronic techniques. The successful applicant will take part in teaching, primarily in the field of electrical machines, and in research.

2. LECTURESHIP/
SENIOR LECTURESHIP
IN ELECTRICAL ENGINEERING.

Candidates should have good academic qualifications in Electrical Engineering or Physics, general experience in electronics and considerable detailed knowledge of solid state devices and circuits. The successful applicant will take part in the teaching of electronics and communication engineering, including fundamental aspects of solid state devices and circuits, and in research.

3. LECTURESHIP IN
ELECTRICAL ENGINEERING.

The successful applicant will be expected to assist in the planning and teaching of control system engineering at graduate and undergraduate levels, and to pursue original research in this or an allied field. Extensive computing facilities are available, as well as a well-equipped control systems laboratory.

The salary for a Senior Lecturer is within the range £A2,550 × £95 to £3,000 per annum; for a Lecturer within the range £A1,730 × £105 to £2,435 per annum. In each case cost-of-living adjustments will be allowed (at present £A29 p.a.). The salary is subject to deductions under the State Superannuation Act. The commencing salary will be fixed according to the qualifications and experience of the successful applicant.

Under the Staff Members' Housing Scheme in cases approved by the University and its Bankers, married men may be assisted by loans to purchase a house.

Further particulars and information as to the method of application may be obtained from the Secretary, Association of Universities of the British Commonwealth, 36, Gordon Square, London, W.C.1.

Applications close, in Australia and London, on 31st January, 1961. 6845

C. A. PARSONS & CO. LTD.

GRADUATE electrical engineers or physicists (preferably with good honours degrees and some practical experience) are invited to discuss opportunities offered in the company's research department for work on various interesting projects in the field of HIGH-VOLTAGE TECHNOLOGY.

Men with drive and initiative are required, who are able to undertake independently both fundamental and applied research work.

Initial applications to the Personnel Manager should give brief details of career and qualifications and indicate special interest in particular positions.

C. A. PARSONS & CO. LTD.
Heaton Works, Newcastle-on-Tyne, 6
6834

***Situations Vacant** (continued)*

ELECTRICAL AND MECHANICAL ENGINEERS

War Department Directorate General of Works

VACANCIES exist for professional MECHANICAL & ELECTRICAL ENGINEERS at HEADQUARTERS at CHESSINGTON and elsewhere in U.K. and overseas.

The work of this recently formed, entirely civilian organisation is similar to that carried out by a consulting engineer with a practice related to large building installations, but with greater emphasis on managerial responsibility, and it provides opportunities for foreign travel.

It covers a wide and interesting field including design, execution and management of electrical supplies and installations, heating, ventilating and air conditioning, refrigeration, water supplies, and a variety of specialised services in War Department centres at home and overseas. These centres consist of large groups of buildings including hospitals, stores, workshops, schools and living accommodation.

Emphasis is placed on the use of advanced techniques and there is a "Development Group" with a laboratory and testing facilities concerned with this aspect. Staff are encouraged to keep abreast of the latest developments and to specialise in selected fields of particular interest to the individual.

Importance is attached to the incorporation into new designs of ideas arising from the experience gained in operation and maintenance. In view of the heavy expenditure on maintenance much attention is devoted to such subjects as fuel economy, planned maintenance and work study.

IF YOU ARE ABOUT THIRTY, a Corporate Member of the Institution of Mechanical or Electrical Engineers (or expect to be one within two years), you should be suitable for a post as Engineer at a starting salary between about £1,300 and £1,500 rising to £1,780. If you have a little more experience you may be suitable for appointment as Senior Engineer at a salary up to £2,000. These salary scales are at present under review. Younger or less experienced men can enter as Assistant Engineers at a salary dependent on age and ability. For all grades a University Degree is an advantage and a broad engineering background desirable.

There are prospects of promotion to higher posts up to £3,000 and possibly above.

IF YOU HAVE JUST GRADUATED, a training scheme is available to qualify you for Corporate Membership of the Institution of Mechanical or Electrical Engineers. Graduates are paid £710-£770 while training.

Some of the posts would be attractive to OLDER MEN WITH EXPERIENCE in maintenance and managerial work. There is no age limit.

Working conditions include a five-day week and on first appointment from 4 to 5 weeks' leave a year as well as public holidays; sick pay and assistance for external training. Overseas tours of service are normally for three years with comprehensive allowances; family passages and children's education. There will be opportunities later for pensionable appointments with transfer, where possible, of existing superannuation.

Apply giving age, brief relevant details of education, qualifications and experience in date order to:—

Mr. C. L. CHAMPION, B.Sc.(Eng.),
A.C.G.I., M.I.C.E., M.I.Mech.E., M.I.E.E.
CHIEF MECHANICAL AND
ELECTRICAL ENGINEER,
WAR OFFICE,
CHESSINGTON,
SURREY.

Please mention any geographical preference for first appointment and state the lowest grade acceptable. This will not prejudice consideration of the applicant for a higher grade. 6846

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE CO. LTD.

Longridge House, Manchester, 4

ELECTRICAL SURVEYOR required in Scotland, also Manchester. Permanent positions carrying progressive salary scale £800 to £1,100 and non-contributory pension. Candidates, aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience. 6847

AEI

Associated Electrical Industries Limited

Switchgear Division

(HIGHER OPENSHAW)

TECHNICAL WRITER

Associated Electrical Industries Limited require a TECHNICAL WRITER with sound engineering experience, preferably in a Switchgear factory. The required qualifications would be H.N.C. or equivalent, with a good command of English and a flair for drafting maintenance instructions and similar publicity material relating to electrical switchgear.

Please write giving brief details of age and experience to :—

Personnel Officer
Associated Electrical Industries Ltd.
Switchgear Division, Higher Openshaw
MANCHESTER, 11

6729

UNITED KINGDOM ATOMIC ENERGY AUTHORITY

require a
POWER PLANT SUPERVISOR
at
CHAPELCROSS NUCLEAR POWER STATION, near ANNAN, DUMFRIESSHIRE

to be responsible, on shift, to the Shift Manager for the operation of electrical and mechanical power plant comprising an 11-kV, 313-kV and 415-v. electrical system, steam-raising heat exchangers, turbo-alternators and associated auxiliaries; the total capacity of the station is 180 MW.

Applicants must have served a recognised engineering apprenticeship and have had considerable experience in the operation of E.H.V. switchgear, turbo-alternators and steam plant. A good knowledge of electricity regulations and maintenance procedures concerning the safety of personnel is essential. Possession of an H.N.C., or equivalent, in Electrical Engineering may be an advantage.

Salary between £1,160 and £1,410 per annum. An additional allowance is paid for regular shift working.

Staff housing and pension schemes. Generous holidays.

Send POSTCARD to Personnel Manager at the above address for application form, quoting reference G.83/J7.

Closing date: 12th December, 1960. 6819

BOROUGH OF EPSOM AND EWELL

Borough Engineer and Surveyor's Department

Appointment of
Street Lighting Superintendent (Misc. VI)

APPLICATIONS are invited for the post of STREET LIGHTING SUPERINTENDENT in the Borough Engineer and Surveyor's Department at a salary in accordance with Miscellaneous Grade VI, commencing at £800 per annum and rising to £865 per annum including London weighting.

Applicants must be qualified electricians and should have had a minimum of 5 years' experience in a supervisory capacity. The possession of a Certificate of the City and Guilds Institute in Electrical Installation or similar qualification will be an advantage.

The person appointed will be required to supervise personnel engaged on street lighting maintenance and other electrical work, and will be required to undertake certain standby duties for which payment will be made.

Applications stating age, qualifications and experience, with the names of three persons to whom reference can be made, should be sent to Mr. Colin Cobbett, M.I.C.E., M.I.Mun.E., Borough Engineer and Surveyor, Town Hall, The Parade, Epsom, so as to reach him not later than Monday, 12th December, 1960.

EDWARD MOORE,
Town Clerk. 6830

DEPUTY REGIONAL ENGINEER

Required by WELSH REGIONAL HOSPITAL BOARD

Applicants must be Corporate Members of the Institution of Civil or Mechanical or Electrical Engineers and preference will be given to persons with previous experience in the Hospital Service.

The successful candidate will deputise for the Regional Engineer over the whole range of duties for which he is responsible and should have a sound administrative background as well as considerable experience in engineering design. He should be able to provide the Board and its staff with authoritative advice and guidance when required in all branches of engineering work and services in hospitals and be responsible for the day to day supervision of the Engineer's department.

Salary : £1,865 x £85 (1) x £100 (3) — £2,250.

The post is superannuable and a five-day week applies.

Applications to Secretary, Temple of Peace and Health, Cathays Park, Cardiff, stating age, qualifications, experience, present position and salary, with names of two referees, within 14 days.

6809

ULTRA RADIO AND TELEVISION LTD.

Continued expansion in the Company's production unit has led to some re-organisation and strengthening of the Factory Management team at *Gosport, Hants.*

There are, immediately, a number of senior vacancies which the Company seeks to fill with the minimum of delay.

ASSISTANT WORKS MANAGER

This is a top management function with full control of all production, engineering, planning, materials supply and progress. There are approximately 1,000 operatives.

Applicants should have sound engineering and production training, preferably with technical qualifications. Executive experience at or about this level in the light engineering field is essential.

Salary for the right person should not be below £1,800 but may be considerably more. Age 35/45.

For this position it will be clear that the Company seeks a man of above average ability—clear thinking—decisive—a manager with thorough engineering training, capable of making a significant contribution in an already dynamic organisation. The appointment can be the subject of a service contract after a satisfactory work-up period.

CHIEF PRODUCTION ENGINEER

This senior management position calls for a man in the same age group, 35/45 with specialist experience. He must be technically qualified with broad engineering training. (Machine Shop and tooling experience in itself not sufficient.) Knowledge of assembly flow techniques, component manufacture and work and motion study are desirable.

There will be full responsibility to the Assistant Works Manager for tooling, methods, processes, materials handling, planning and all pre-production preparation for the mass production of TV and radio.

The ability to co-ordinate and instruct senior supervisors to obtain maximum production is vital.

Salary should not be less than £1,600 but again may be more for the right man.

For this position it will be clear that the Company seeks a man of above average ability—clear thinking—decisive—a manager with thorough engineering training, capable of making a significant contribution to an already dynamic organisation. The appointment can be the subject of a service contract after a satisfactory work-up period.

PRODUCTION SUPERINTENDENT

This is a stimulating and exacting post for a well qualified engineer, aged between 35 and 45. Experience of radio and television or allied industries essential. The successful candidate, who will report to the Production Manager, will supervise a medium sized production unit and must be able to plan and control tight production schedules. The post requires knowledge of cost control in mass production and assembly and of the efficient operation of bonus schemes.

This is a senior and progressive post; the production Superintendent will inspire confidence and enthusiasm and promote a team spirit to produce worthwhile results quickly. Salary will be open to negotiation, but will be at least £1,400 for the right man.

WINDING DEPARTMENT SUPERINTENDENT

This is a post for a well-experienced superintendent, age 30 to 40 for the winding department. Knowledge of multi-winders and special purpose winding machines using fine wires is essential as well as experience in the radio industry. The department employs some 200 females and the right man will have the ability and personality to control and inspire his staff and to plan and work to a tight production schedule. Cost control and the operation of a bonus scheme are important functions of the post, which demands conscious quality control combined with the need for high output. The ideal applicant, of progressive outlook, can expect to earn £1,200 p.a. and the prospects are unlimited.

ASSEMBLY FOREMEN

These are junior management posts in a vigorous, dynamic production team and offer excellent prospects for rapid promotion. We are looking for men, aged 28/40, with good engineering and supervisory backgrounds, preferably with technical qualifications. Experience of mass assembly in radio, television or allied industries is required, combined with the ability to control 150 operatives who will be working to tight schedules geared to flow conveyors assembly. The initial salary will be according to qualifications and experience, but for the right men—senior managers in the making—will not be less than £1,000 p.a.

Applications for these posts should be sent, with full details of qualifications and experience to:

WORKS MANAGER, ULTRA RADIO AND TELEVISION LTD., TELEVISION HOUSE, EASTCOTE, RUISLIP, MDDX.

INTERVIEWS can be arranged at the Company's Head Office at Eastcote, Middlesex, or in Central London.

6807

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

PLANT SHIFT CONTROL ENGINEER
CASTLE DONINGTON
POWER STATION
(Vacancy No. 259/60).

Applications are invited for the position of Plant Shift Control Engineer at Castle Donington Power Station, near Derby.

Candidates should have had operating experience on large modern pulverised fuel fired boilers and associated turbines.

Salary will be in accordance with Class L, Grade 10 (£1,190-£1,325 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 3rd December, 1960.

GENERAL ASSISTANT ENGINEER,
DRAKELOW POWER STATION
(Vacancy No. 261/60).

Applications are invited for the position of General Assistant Engineer at Drakelow Power Station, near Burton-on-Trent.

The successful applicant will be given opportunities to obtain experience in all sections of a power station.

Preference will be given to candidates who hold the Higher National Certificate or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

The salary during the initial training period will depend on qualifications and knowledge, and will be within the range £625-£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1960.

GENERAL ASSISTANT ENGINEERS,
CASTLE DONINGTON
POWER STATION
(Vacancy No. 263/60).

Applications are invited for the positions of General Assistant Engineers at Castle Donington Power Station, near Derby.

Duties will include operation, planning and general plant investigation work.

Applicants should have had experience in power stations or have completed an engineering apprenticeship.

The salary during the initial training period will depend on qualifications and knowledge, and will be within the range £625-£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent concerned and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.

18th November, 1960. 6856

DOULTON INSULATORS

SALES ENGINEER —ELECTRICAL

An exceptional opportunity occurs for a young engineer with qualifications up to H.N.C. and sound basic training, preferably connected with insulation problems, experience in the fields of switchgear or transmission line practice would be an advantage.

The successful applicant will be located in London and his duties will involve speciality technical sales work with exceptional opportunities for advancement in an expanding organisation.

Apply in writing, stating salary required, to The Sales Director, Doulton Industrial Porcelains Limited, Doulton House, Albert Embankment, London, S.E.1.

6813

THE ESSO PETROLEUM COMPANY LIMITED

invites applications for the following position at their Refinery at Fawley near Southampton:—

ELECTRICAL PROJECT ENGINEER

for the design and preparation of estimates, specifications and system calculations associated with high-voltage substations, distribution systems, large H.V. machines and electric power and lighting installations for all types of oil refinery and chemical processes. Previous estimating and design experience is essential, and preference will be given to candidates with some maintenance and installation experience. Minimum technical qualifications equivalent to Corporate Membership of the Institution of Electrical Engineers.

There is a contributory pension scheme, sickness and accident benefit scheme, and a comprehensive appraisal development scheme.

The Esso Refinery is on the west side of Southampton Water and on the borders of the New Forest.

Applicants should send full details of education and experience, quoting this journal, to the:—

Employee Relations Superintendent
Esso Refinery
Fawley, Nr. Southampton, Hampshire

6774

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Dundee Area

APPLICATIONS are invited for the undermentioned appointment:—

SECOND ASSISTANT ENGINEER
(Planning).

Applicants should have had a sound technical education and have obtained a Higher National Certificate or Engineering Degree. Preference will be given to Corporate Members of the Institution of Electrical Engineers.

Applicants should be well experienced in city and rural transmission and distribution planning up to 33 kV. The successful candidate will be required to assess load development and deal with forward planning for distribution.

Duties will include planning of H.V. and L.V. reinforcements, distribution to new high-density housing and city redevelopment works, also design of indoor and outdoor substations up to 33 kV.

Salary will be in accordance with National Joint Board Agreement, Schedule A, Class H, Grade 7, £1,190 to £1,325 (Scale 10).

Applications should be on the standard application form obtainable from the Area Manager, Dundee Area, 7, Dudhope Crescent Road, Dundee, and should be returned by the 12th December, 1960. 6818

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

Croydon B Power Station

ASSISTANT ENGINEER (Relief) (Vacancy No. 169a/60R) required to undertake relief duties primarily in the control room and to assist generally in the various aspects of work in the station. Candidates should have a suitable engineering background and preferably have had technical training to at least O.N.C. level.

Salary N.J.B. Class J, Grade 14, £805-£920 per annum including London allowance, plus shift allowance when applicable.

Applications giving age, details of experience, qualifications, etc., and quoting Vacancy No. should be sent to the Station Superintendent, Croydon B Power Station, Beddington Farm Road, Croydon, Surrey, to arrive by 5th December, 1960.

W. H. DUNKLEY,
Divisional Controller.

6863

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointments in the System Operation Department, Thames North Grid Control Centre, Redbourn, near St. Albans, Herts.

(a) THIRD ASSISTANT ENGINEERS (S.V. No. 1397). Salary N.J.B. Class BX, Grade 8, Scale 11, £1,105-£1,410 per annum, plus 10% shift allowance.

(b) FOURTH ASSISTANT ENGINEERS (S.V. No. 1398). Salary N.J.B. Class BX, Grade 9/11, within the range of Scales 8/10, £855-£1,325 per annum.

Applicants who applied as a result of the recent advertisement need not re-apply as they will automatically be reconsidered.

The commencing salaries will be within the above ranges at points commensurate with qualifications and experience. The minimum technical qualification required is the Higher National Certificate in Electrical Engineering.

Some generating station and/or transmission/technical experience is essential in the case of appointment (a) and is desirable for appointment (b). The successful applicant in the case of appointment (a) will be required to undertake shift duties in the Grid Control Room. In the case of appointment (b) the duties are on day work and are of a general technical and statistical nature, but applicants must be prepared ultimately to undertake shift duties in the Grid Control Room.

Forms of application (AE.6/ACT) may be obtained from the Board's Headquarters, or from any Divisional Offices of the Board, and should be addressed to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., to arrive not later than 10th December, 1960, quoting the appropriate reference S.V. No. 6832

FEDERATION OF RHODESIA AND NYASALAND FEDERAL POWER BOARD

Staff Appointments

APPLICATIONS are invited for the post of

METER TECHNICIAN
(SALARY £1,650 PER ANNUM)

Applicants should be suitably qualified. Experience of integrating meters, summators, printometers, indicating and recording instruments, sub-standard instruments, potentiometers and methods of standardising is essential.

The successful applicant will be based at Salisbury, but will be required to travel periodically throughout the Board's system.

Reasonable transfer and removal expenses will be paid for the successful applicant and his family and there is a pension scheme which he will be required to join.

Applications giving particulars of age, training, qualifications, experience and marital status should reach the Secretary, Federal Power Board, P.O. Box 630, Salisbury, Southern Rhodesia, not later than 20th December, 1960. 6828

BICC

Vacancy in London for

SPECIFICATION WRITER / DESIGNER

for lighting, heating and power wiring within buildings of all types. Qualifications to H.N.C. or equivalent. Applicants should have had practical experience in the electrical contracting industry and of reading building drawings.

Five-day week. Pension fund. Staff restaurant. Excellent conditions and prospects.

Apply in writing to Personnel Officer, British Insulated Callender's Cables Ltd., 21, Bloomsbury Street, London, W.C.1.

6825

METALS DIVISION

An

ELECTRICAL APPLICATIONS ENGINEER

is required for the Division Engineering Department of Imperial Chemical Industries Limited at WITTON, near Birmingham.

Responsibilities include the design, application and co-ordination of electrical installations in a variety of plants.

Candidates, preferably in the age range 30/35, with corporate membership of the Institution of Electrical Engineers, should have a degree in electrical engineering and wide experience in heavy electrical engineering, including the application and layout of electrical equipment, switchgear and control equipment.

This appointment is pensionable and the Company operates a Profit-Sharing Scheme. Assistance can be given towards house purchase and removal expenses for married men.

Please write for an application form to the

Assistant Personnel Manager (Staff)
IMPERIAL CHEMICAL INDUSTRIES LIMITED
Metals Division, P.O. Box 216, Kynoch Works, WITTON, Birmingham 6

quoting Eng/439/ER

6826

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts :—

Wolverhampton & District Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER (Lichfield).

Applicants should have had experience in the construction and maintenance of high and medium-voltage distribution systems. Technical qualifications desirable. Salary £825/£940 per annum (N.J.B. Grade E.9).

Apply by letter stating age, qualifications, experience, present position and salary to Mr. D. Holt, Sub-Area Manager, Midlands Electricity Board, 83, Darlington Street, Wolverhampton.

Worcester & District Sub-Area

DEMONSTRATOR (Female) (Redditch/Bromsgrove).

Applicants must have had a good education and should have a certificate of a recognised domestic training college and/or the E.A.W. Certificate. Some selling experience would be an advantage. Duties include lecture demonstrations in service centres and on consumers' premises and advice to consumers on the selection and use of electrical apparatus. Applicants must be prepared to take an active part in the sales organisation. Salary £600/£700 per annum (N.J.C. Grade 1).

Apply by letter, within 10 days, stating age, education, qualifications, training and experience to District Manager, Midlands Electricity Board, Windsor Road, Redditch, Worcs.

F. W. CATER,
Secretary. 6844

TECHNICIAN

MINISTRY OF AVIATION, Boscombe Down, Wiltshire, require TECHNICIAN to supervise electrical workshops concerned with maintenance, inspection and operation of wide variety of aircraft electrical systems and components.

Qualifications recognised engineering apprenticeship. O.N.C., C. and G. Final Certificates or equivalent. Experience in electrical field of aircraft maintenance and workshops. Knowledge of routine inspection and aircraft safety regulations an advantage. Prospects for promotion and pension.

Salary £925 - £1,055.

Application forms from Manager (PE.3257), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. 6833

NORTH WESTERN ELECTRICITY BOARD

Fourth Assistant Engineer (Protection),
Carlisle Testing Station,
Sub-Area Engineering Department

DUTIES will include assisting with work in connection with protective gear testing and maintenance, high-voltage pressure testing and cable fault location. Some knowledge of polyphase meter testing work would be an advantage. Preference given to applicants who hold H.N.C. in Electrical Engineering.

Salary scale £890 × £25 to £1,015 p.a., Grade K.13. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 6 Sub-Area, North Western Electricity Board, Castle Green, Kendal, and returned to him by 5th December, 1960.

6827

ATLAS LIGHTING LIMITED

require keen

TECHNICIANS

age 18-35 years for interesting work on the development of ultra-modern lamps, in a laboratory situated in North London.

Applicants should be of H.N.C. standard or 'A' level Physics. Previous experience in lamp making, glass working, high vacuum or lighting techniques would be advantageous.

Write giving full details of experience and qualifications to :

ATLAS LIGHTING LIMITED (DEV/LAB)
Angel Factory Colony, Angel Road, Edmonton, London, N.18

6726

***Situations Vacant** (continued)*

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Fens Sub-Area

SUB-AREA HEADQUARTERS
Nr. CAMBRIDGE

WAYLEAVE ASSISTANT (309/60.R).

Duties include the negotiation of wayleaves for overhead lines and the settlement of damage claims within the Fens Sub-Area.

Salary N.J.C. 3 (£780-£880).

Apply by letter to the Manager, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge, by 9th December, 1960.

Northmet Sub-Area

ENFIELD DISTRICT

DISTRICT ENGINEER (Ref. 1018) (310/60.R.E.R.).

Candidates should have had wide experience in the planning, construction, operation and maintenance of overhead and underground distribution systems, including substations, and should be capable of organising and supervising the engineering work of the District.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary N.J.B. Class G, Grade 3 (£1,440-£1,610), plus London allowance.

It is expected that the District will be re-classified H from 1st April, 1961.

Apply by letter to A. T. Durbridge, Manager, Eastern Electricity Board, 40, Church Street, Enfield, Middlesex, by 5th December, 1960, quoting the above reference number in full.

HERTFORD DISTRICT

SECOND ASSISTANT ENGINEER (Ref. 1014) (313/60.R).

Candidates should have had a sound technical training and considerable experience in the construction, operation and maintenance of underground distribution systems at voltages up to and including 33 kV.

Salary N.J.B. Class G, Grade 7 (£1,115-£1,245).

Apply by letter to W. H. Hatton-Ward, Assoc.I.E.E., A.M.B.I.M., Manager, Eastern Electricity Board, Bridgefoot, Ware, Herts., by 5th December, 1960.

Chilterns Sub-Area

BEDFORD DISTRICT

DEMONSTRATOR (312/60.R).

Candidates should have had domestic science training including electrical housecraft; should preferably hold the E.A.W. Certificate and be competent to plan and give cookery demonstrations including lectures and advice to consumers on the utilisation of domestic electrical apparatus. Previous experience in an electricity showroom is desirable.

Salary N.J.C. Grade 1 (£600-£700).

Apply by letter to the Manager, Bedford District, Eastern Electricity Board, Prebend Street, Bedford, by 20th December, 1960. 6864

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following position:—

THIRD ASSISTANT ENGINEER (Meters), Devon Group, located at Newton Abbot.

Salary according to Class K, Grade 11, Salary Scale 8, £1,040 to £1,165 per annum, of the N.J.B. Agreement.

The successful candidate will be required to carry out general technical and supervisory duties in a Class A polyphase meter test station.

Applicants should have a knowledge of single- and three-phase meter testing and repair, standardisation of instruments in accordance with the Electricity Supply Acts, repairs and calibration of all types of instruments, and general test room organisation. Possession of the Higher National Certificate in Electrical Engineering or an equivalent qualification will be an advantage and a current driving licence is desirable.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POSTCARD ONLY, from the Group Administrative Officer, South Western Electricity Board, 57, Paul Street, Exeter. Closing date for receipt of completed applications is 10th December, 1960. 6873

MK

M.K. ELECTRIC LIMITED

have the following vacancies in their Technical Drawing Office:—

DESIGNERS—experienced in the design of small Electrical/mechanical products for large quantity manufacture.

DRAUGHTSMEN—with routine Drawing Office experience and preferably in connection with small electrical products — preparing standard drawings, data sheets, etc.

Excellent working conditions in a new drawing office. Five-day week of 37½ hours. Holiday arrangements honoured and attractive salaries offered according to experience.

Applications treated in strict confidence if addressed to:—

Technical Manager, M.K. ELECTRIC LTD.
Shrubbery Road, Edmonton, London, N.9

6885

FEDERATION OF RHODESIA AND NYASALAND FEDERAL POWER BOARD

Staff Appointments

APPLICATIONS are invited for the post of

SENIOR ASSISTANT COMMUNICATIONS ENGINEER
(SALARY £2,150 P.A.)

Applicants should be fully qualified and thoroughly experienced in all aspects of the telecommunications work as applied to power system requirements.

The duties of the post will be connected with the commissioning and maintenance of power line carrier, voice frequency telegraph, remote control and indication, telemetering, teleprinter, H.F. radio and P.A.X. equipment. Some knowledge of power system protection would be an advantage.

The successful applicant will be stationed at the Board's headquarters in Salisbury, Southern Rhodesia, but some travelling throughout the Board's system will be necessary.

Reasonable transfer and removal expenses will be paid for the successful applicant and his family and there is a pension scheme which he will be required to join.

Applications giving particulars of age, training, qualifications, experience and marital status should reach the Secretary, Federal Power Board, P.O. Box 630, Salisbury, Southern Rhodesia, not later than 20th December, 1960. 6829

DESIGNER

APPLICATIONS are invited from Engineers with qualifications of at least H.N.C., preferably in Mechanical Engineering, for design and development work on M.V. circuit breakers and fuse switchgear. Creative initiative and aptitude for design work is important, switchgear experience desirable.

Good salary and prospects with a company near the South Devon coast. There is a non-contributory pension scheme, and housing accommodation will be available if required.

Apply giving full details of qualifications and experience to the Chief Designer, Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 6626

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

STATION SHIFT CONTROL ENGINEER (Vacancy No. ER/AV/170/60) required at Portishead "B" Power Station.

Superannuation scheme. Salary N.J.B. Class K, Grade 10, Scale 9, £1,115-£1,245 per annum plus 10% shift allowance.

Candidates should possess good technical qualifications and should have had training and experience in the control and operation of steam generating plant and main switchgear in a large modern power station.

THIRD ASSISTANT ENGINEER (Vacancy No. ER/AV/171/60) required in the Protective Gear Section, Maintenance and Operation Branch of the Divisional Electrical Department at Bristol.

Superannuation scheme. Salary N.J.B. Class AX, Grade 8, Scale 10, £1,105 - £1,325 per annum.

Applicants should possess qualifications leading to Corporate Membership of the Institution of Electrical Engineers and should have a keen interest in all forms of transmission and generating plant protection. Experience in the application and testing of protective systems and a good knowledge of report writing is essential.

Previous applicants need not apply.

Applications on form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed, quoting vacancy number, and returned by 5th December, 1960. 6857

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 313/ER/60

APPLICATIONS invited for the superannuable N.J.B. appointment of ASSISTANT ENGINEER (Operation and Efficiency) at USKMOUTH "A" POWER STATION, West Nash, Nr. Newport, Mon.

Salary Schedule A, Class K, Grade 7, Scale 12 (£1,350-£1,500 per annum).

Applicants should possess H.N.C. or equivalent qualifications, and the ability to carry out plant tests and make special investigations for efficient operation.

Special application forms obtainable from Secretary, Central Electricity Generating Board, South Wales Division, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 9th December, 1960. 6861

AIR MINISTRY

STATION ENGINEERS (G.D.) and STATION ENGINEERS (Mech.) required at R.A.F. and Ministry of Aviation stations throughout the United Kingdom. The work of Station Engineers (G.D.) consists of installation, operation and maintenance of high and medium-voltage electrical distribution systems, electrical power and lighting installations, control systems and generating plant; knowledge of heating and ventilating plant and diesel engines an advantage. Station Engineers (Mech.) are concerned with diesel power plant, steam and hot water heating systems, refrigeration and air conditioning and miscellaneous workshop plant, tools and equipment.

Candidates should hold O.N.C. Elec. or Mech./C. and G. Electrical Technicians Certificates/2nd Class M.O.T. Certificate or equivalent, and must also have had recognised apprenticeship with firm of good repute plus 3 years' employment in electrical or mechanical and engineering, preferably on operation and maintenance of mine, factory or workshops plant and services. Preference to candidates with supervisory experience.

Commencing salary, which is dependent upon age, qualifications and experience, ranges from £745 (age 25) to £925 max. in Grade III. There are pension prospects and also opportunities of advancement to numerous posts in the higher grades vacancies which, as a rule, are filled by promotion of Grade III staff, viz.:—

Technical Grade II .... (276 posts)	£925-£1,055
Inspector of Works Grade I (137 posts)	£1,055-£1,295
Technical Grade B .... (25 posts)	£1,295-£1,491
Technical Grade A .... (17 posts)	£1,385-£1,630

Overseas tours for which special allowances ranging at present up to £1,800 p.a. are payable in addition to a higher salary. Internal training courses are provided and financial assistance and time off is allowed for recognised courses of study leading to higher qualifications. 5-day week with 18 days' paid leave a year initially.

Applicants, who must be natural-born British subjects, up to age 55, should write stating age, qualifications and experience to the Manager (P.E.1), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. No original testimonials should be sent. Candidates selected will normally be interviewed in London and certain expenses reimbursed. Only applicants selected for interview will be advised. 249

ELECTRICAL FOREMAN

required by

ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL

to be responsible for circuitry modification on reactors and ancillary equipment.

Work includes investigation into circuitry facilities, approval of electrical modifications to such circuits and some administrative duties connected with electrical ancillary plant, records and programme planning of modification work.

SALARY £1,160-£1,410 p.a.

Applicants should have served a recognised engineering apprenticeship or have had equivalent training in the light/medium power electrical engineering field, and subsequently have had wide experience in the above work but not necessarily on reactors. H.N.C. or equivalent desirable.

Housing and contributory pension schemes.

Send POSTCARD for details to Personnel Manager (1844/48), U.K.A.E.A., A.E.R.E., Harwell, Didcot, Berks. 6812

ELECTRICAL ENGINEER

required for the electrical department of an expanding mechanical engineering company in the manufacture of equipment for the paper and corrugating industries. The candidate should have a Higher National Certificate (Electrical), have served an apprenticeship, and be aged 25-30. The work is varied and interesting, dealing mainly with specialised drives and controls for capital plant. A pension scheme is in operation.

Written applications to Masson Scott & Co. Ltd., Riverside Road, Summerstown, London, S.W.17. 6733

SOUTH EASTERN ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER,
Woking District.

Salary £1,190-£1,325 per annum under N.J.B. F.5, with progression to Grade 4 (maximum salary £1,410), subject to satisfactory service. Superannuable. Applicants, preferably qualified to H.N.C. in Electrical Engineering standard or equivalent, should be conversant with tariff negotiations, sales activities, contracting and general load development. The appointment offers wide scope for experience in domestic, industrial and rural development. Consideration would be given in appropriate circumstances to assistance with housing.

Applications, quoting ER, on forms from District Manager, SEEBOARD, 4, Chobham Road, Woking, by 7th December, 1960.

ASSISTANT DISTRICT ENGINEERS,
Dorking and Epsom.

Salary £765-£860 per annum under N.J.B. Agreement, Class F, Grade 11. Superannuable. These appointments occur in a pleasant urban and rural district. Applicants should have the minimum qualification of the O.N.C. in Electrical Engineering and should possess general engineering experience, preferably in the supply industry. Consideration will be given to a private car allowance and assistance for house purchase in appropriate circumstances.

Applications, quoting ER, on forms from District Manager, SEEBOARD, 56, South Street, Dorking, by 7th December, 1960.

SHOWROOM SUPERVISOR,
Sutton District.

Salary £1,020-£1,140 per annum under N.J.C. Agreement, Grade 5, plus £50 p.a. London weighting. Superannuable. Applicants should have an extensive knowledge of showroom procedure, display techniques, sales promotion, stock control, the application of tariffs, and be experienced in the supervision of sales staff. The possession of the E.D.A. salesmanship qualifications is essential.

Applications, quoting ER, on forms from District Manager, SEEBOARD, 52, High Street, Sutton, Surrey, by 7th December, 1960.

GEORGE WRAY,
Secretary. 6871

THE UNIVERSITY OF MANCHESTER

APPLICATIONS are invited from suitably qualified graduates for two posts in the DEPARTMENT OF ELECTRICAL ENGINEERING of the Faculty of Science as LECTURER and ASSISTANT LECTURER. Candidates with interests in any of the branches of Electrical Engineering would be considered, but one of the appointments will be made in the field of measurements and/or automatic control.

The salary scales are as follows: Lecturer, £1,050 to £1,850 per annum; Assistant Lecturer, £800 to £950 per annum; initial salary and status according to qualifications and experience. Membership of F.S.S.U. and children's allowance scheme.

Applications should be sent not later than 3rd December, 1960, to the Registrar, The University, Manchester, 13, from whom further particulars and forms of application may be obtained. Overseas applicants should send letters of application (no forms) as soon as possible, giving details of qualifications and experience, and should submit the names of at least three persons to whom reference may be made. 6754

HUDDERSFIELD COLLEGE OF TECHNOLOGY

Principal: Dr. W. E. Scott, M.B.E.

Amended Advertisement

APPLICATIONS are invited for the post of HEAD OF THE DEPARTMENT OF ELECTRICAL ENGINEERING. Candidates should possess a good degree, should have had experience in industry, and should preferably be Corporate Members of the Institution of Electrical Engineers.

Salary (Burnham Scale), Grade III, £1,800 p.a. by £50 p.a. to £1,950 p.a.

Application forms and further particulars obtainable from the Principal, to whom applications should be returned without delay.

H. GRAY,
Clerk to the Governors.

4th November, 1960. 6731

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Planning).

Basingstoke District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class F, Grade 11 (£705-£870 per annum). N.J.B. conditions of service.

The duties of the post will be to assist in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks and to undertake standby duties if required. Suitable technical qualifications are necessary.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, quoting Z.1228, not later than 5th December, 1960.

Wayleave Officer

Sub-Area Engineer's Department of No. 1 (Southall) Sub-Area, located at Waterloo Road, Uxbridge. Salary N.J.C. Grade 2 (£700-£775 per annum, plus London weighting). N.J.C. conditions of service.

The duties of the post will include ability to negotiate wayleave agreements for the erection or laying of electric lines and installation of substations and plant.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.1260, not later than 5th December, 1960.

Demonstrator

Yeovil District of No. 4 (Bournemouth) Sub-Area, located at Shaftesbury. Salary N.J.C. Grade 1 (£600-£700 per annum). N.J.C. conditions of service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus, and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent domestic science qualification would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting Z.1285, not later than 5th December, 1960.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. 6841

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

Croydon A Power Station

STATION SHIFT CONTROL ENGINEER (Vacancy No. 232/60) required at Croydon A Power Station, Factory Lane, Croydon.

Applicants should have had a good general education and technical training, and should preferably hold the H.N.C. Practical experience of control room operation and switchgear isolation is necessary.

Salary Class F, Grade 10, £965 to £1,084 per annum including London and shift allowances.

Applications giving age, details of experience, qualifications, etc., should be sent to the Station Superintendent, Croydon B Power Station, Beddington Farm Road, Croydon, Surrey, to arrive by 5th December, 1960. 6862

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Northern Area

Senior Commercial Assistant (Sales)

APPLICATIONS are invited for the above post at Dingwall. Applicants should possess a proved record of successful sales achievement and have wide experience in advising on all matters pertaining to the use of electricity in a predominantly rural area. The successful candidate would be responsible for the control of showrooms, sales, demonstrating and advisory staff.

Salary N.J.C. 6, £1,150 × £30 to £1,240 with placing according to qualifications and experience.

Applications stating age, qualifications and experience to be forwarded to the Area Manager, Church Street, Dingwall, by 5th December, 1960. 6869

***Situations Vacant** (continued)*

YORKSHIRE ELECTRICITY BOARD

Head Office

CHIEF ENGINEER'S DEPARTMENT
SECOND ASSISTANT ENGINEER,
Distribution Design (Substations).

Duties will include the design of indoor and outdoor substations operating at voltages of 33kV and above, the preparation of specifications for substation plant and subsequent negotiations with plant manufacturers. They will also cover protective gear applications on the primary h.v. system.

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers and hold a University Degree in Electrical Engineering. They should have a sound general knowledge of substation plant and design requirements and have had some experience of field construction.

Salary N.J.B. Class BX, Grade 5, £1,375/£40/£1,495 per annum (transitional) to Scale 14, £1,535/£1,720 per annum.

Applications should be sent to the Secretary, Yorkshire Electricity Board, Wetherby Road, Scarcroft, Nr. Leeds, not later than 2nd December, 1960.

No. 5 (Wakefield) Sub-Area

BARNSLEY DISTRICT
THIRD ASSISTANT DISTRICT
ENGINEER.

Applicants should have had a sound practical training and some experience in the construction, operation and maintenance of H.V. and M.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Candidates must be prepared to reside in the district and undertake standby duties.

Candidates must possess a Higher National Certificate in Electrical Engineering, or equivalent technical qualifications.

Salary N.J.B. Class J, Grade 9 (Scale 9), £1,115/£1,245 per annum.

Applications, together with the names of two referees, should be sent to the Manager, Yorkshire Electricity Board, No. 5 (Wakefield) Sub-Area, 1a, Denby Dale Road, Wakefield, not later than 2nd December, 1960. 6860

SOUTH WALES ELECTRICITY BOARD

Assistant Engineer

APPLICATIONS are invited for the position of ASSISTANT ENGINEER in the Pontardawe/Ammanford District in the Swansea and West Central Area.

The District covers 150 square miles, serves 23,000 consumers, has a distribution system which is mainly overhead, and also has an appreciable industrial load. The successful applicant will be required to undertake a wide variety of engineering duties, and the post would be well suited to an engineer, preferably possessing the Higher National Certificate in Electrical Engineering, who wishes to obtain more varied experience.

Salary N.J.B. Class F, Grade 11, Scale 4 (£765-£870 per annum).

Applications stating age, present position, present salary, qualifications and experience should be addressed to G. R. T. Edwards, B.Sc., M.I.E.E., M.Am.I.E.E., Manager, Swansea and West Central Area, 29, Ystrad Road, Swansea Industrial Estate, Swansea, to arrive not later than Saturday, 10th December, 1960. Please quote reference 211/60/E.R. endorsing envelope "Assistant Engineer."

R. G. WILLIAMS,
Secretary. 6872

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT SECTION ENGINEER required in the Conway Valley District of the Board's No. 4 Sub-Area. Salary within the range £825/£940 per annum (N.J.B. E/9).

Applicants should preferably have had experience in the construction, operation and maintenance of overhead and underground high and medium voltage networks, with their associated substations and equipment.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, nr. Wrexham. Closing date 5th December, 1960. 6859

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointment in the Generation Department (Construction Section) at Divisional Headquarters, Cockfosters, in North London.

SENIOR ASSISTANT
ENGINEER (Construction).

Salary N.J.B. Class AX, Grade 1, Scale 17, £1,885-£2,145 per annum inclusive of London weighting.

The successful applicant will be required to carry out the co-ordination of mechanical, electrical and construction sections concerned with schemes ancillary to the Board's generating stations and other establishments.

The duties involve responsibility for drawing office services and for the design and engineering of complete projects up to £250,000 each, including the supervision of staffs concerned.

Applicants should be corporate members of one or more of the senior engineering institutions and have a broad experience in the construction and operation of generating stations.

Applications, quoting reference S.V. No. 1409, stating age, qualifications, experience and present position should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts, to arrive not later than 3rd December, 1960. 6842

OVERSEAS SUPERVISING ENGINEER

BRUSH ELECTRICAL ENGINEERING Company Limited invite applications for the position of OVERSEAS SUPERVISING ENGINEER to be responsible for full technical supervision of comprehensive power contracts. Applicants should have good experience of prime movers, particularly steam turbines, and a background of power plant constructional work and commissioning, including the electrical side.

APPLICATIONS WILL BE TREATED IN THE STRICTEST CONFIDENCE and should contain full details of technical qualifications, experience, age, etc. These should be addressed to

Mr. P. A. McCaig,
BRUSH ELECTRICAL ENGINEERING COMPANY LIMITED
Loughborough, Leicestershire
quoting reference: PL.9100. 6865

LIVERPOOL REGIONAL HOSPITAL BOARD

ENGINEER, MAIN GRADE (Electrical) required in the electrical section under the supervision of a senior electrical engineer on the staff of the Regional Engineer's Division of the Board's Headquarters.

Applicants should be Corporate Members, or Graduate Members with at least five years' relevant experience, of the Institution of Electrical Engineers.

The post calls for drawing board and design experience of electrical installations including H.V. and M.V. distribution systems. Candidates should be conversant with lighting, power, lifts, telephone systems and other electrical services, the preparation of drawings, specifications, reports and have a good knowledge of installation practice.

Salary scale £910 × £30 (1) × £40 (2) × £45 (5) × £50 (7) to £1,600, with a bar at £1,205 for graduate members until corporate membership has been attained. Starting salary according to experience up to £1,300 in the case of corporate and £1,205 in the case of graduate members.

Applications stating age, qualifications, experience, present and previous posts with names and addresses of three referees (two technical), to me at 55, Castle Street, Liverpool, 2, not later than 6th December, 1960.

VINCENT COLLINGE,
Secretary to the Board.
6867

LONDON ELECTRICITY BOARD

APPLICATIONS are invited for the undernoted positions in the Board's Western District at 154, Uxbridge Road, Shepherd's Bush, London, W.12.

ASSISTANT DISTRIBUTION
ENGINEER
(Ref. PER/V/3103/R).

N.J.B. Agreement, Schedule A, Class H, Grade 9, £1,090-£1,215 p.a. inclusive of London allowance.

Applicants should have had a sound technical education to the standard of the Higher National Certificate, and possess practical experience in all branches of engineering work associated with the organisation of a District distribution department.

GENERAL ASSISTANT
ENGINEER
(Ref. PER/V/3109/R).

Provisional minimum salary £685 p.a. rising to £855 p.a. inclusive of London allowance.

Applicants should have a sound technical education to the standard of the Higher National Certificate and have completed a recognised period of training in the electricity industry, or have equivalent experience.

Applications in writing should be made to the District Manager at the above address, within 14 days of the publication date of this notice. Please quote appropriate reference. 6870

NORTH EASTERN ELECTRICITY BOARD

Organisation and Methods Officer

APPLICATIONS are invited for an ORGANISATION AND METHODS OFFICER on the staff of the Board's Liaison Officer at Area Headquarters, Newcastle upon Tyne. The vacancy arises as a result of promotion of the Organisation and Methods Officer.

Applicants must be capable of taking charge of an established unit which undertakes investigations into matters of organisation, administrative procedures and office routines. Professional training as accountant, engineer or secretary and responsible experience in a large organisation are desirable. The ability to present clear and objective reports and to work with staff at all levels is essential.

Salary in accordance with Class B, Grade 5 of the N.J.M. and H.E. Grades Committee Agreement for the Electricity Supply Industry, viz. £1,965 to £2,170 per annum, according to qualifications and experience.

Applications stating age, qualifications and experience, to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 6868

A LONDON CONSULTING ENGINEER

engaging staff for large and interesting new projects now requires supporting staff for his Senior Electrical Engineers. The grade most required is that of JUNIOR ELECTRICAL ENGINEER/DRAUGHTSMAN to work on electrical installation design within buildings, the salary for this grade being £650 to £850 according to experience in this field.

Preference will be given to applicants with some practical training and holding Ordinary National Certificate.

The organisation, which is well known to industry and commerce has welfare and social facilities, luncheon vouchers issue and a superannuation scheme.

Applicants should state age, experience, qualifications and salary required.—Box 6875.

FREDERICK S. SNOW & PARTNERS

Consulting Engineers

ASSISTANT ELECTRICAL ENGINEERS required with experience in the design and preparation of schemes for lighting and power installations in industrial buildings for vacancies in their London office.

Applicants should have served an apprenticeship or have equivalent practical training and must hold National Certificate or equivalent qualifications.

Applicants should send, in confidence, details of education, training, age and experience to:—

Ross House, 144, Southwark Street
London, S.E.1

6874

BRITISH BROADCASTING CORPORATION

requires Engineer in Planning and Installation Department, London, initially to undertake work on power installations for transmitter and studio premises. Preference given to applicants capable of extending their field of activity to installation, testing and commissioning of radio frequency equipment. Opportunities to gain necessary experience.

Applicants must be British subjects, preferably holding qualifications recognised for Graduate Membership of I.E.E., and should have had site installation practice and practical experience in manufacturer's works. Specific experience of diesel alternator installations desirable but not essential.

Salary, commensurate with qualifications and experience, in scale £1,230 to £1,580 p.a.

Requests for application forms to Engineering Recruitment Officer, Broadcasting House, London, W.1, quoting reference 60.E.163 E.R.

6811

CORPORATION OF KIRKCALDY

Lighting Department

TECHNICAL ASSISTANT required. Duties include (a) preparation (under control of Lighting Superintendent) of schemes for street lighting and general electrical contracting work; (b) preparation of final drawings for above works, and (c) administrative duties including control of office staff.

J.I.C. service conditions; salary Executive Division III, £735 to £795; post pensionable; medical examination.

Canvassing direct or indirect disqualifies. Declare relationship to member of Council or chief official.

Applications, with names of two referees, to Lighting Superintendent, Town House, Kirkcaldy, by 10th December, 1960. 6853

OPPORTUNITY WITH A FUTURE

TO deal with an increasing volume of business we require additional SALES ENGINEERS experienced in handling either home or overseas enquiries for H.V. and M.V. switchgear, transformers and contactor equipment. There is wide scope and opportunity for the right men who must have the essential qualities of drive and initiative. Technical qualifications up to H.N.C. level are preferred.

The working conditions are pleasant and congenial in a modern switchgear manufacturing organisation.

Write in the first instance to:—

The Chief Sales Engineer
SOUTH WALES SWITCHGEAR LIMITED
Blackwood, Monmouthshire 6796

GLIKSTEN (WEST AFRICA) LTD.

Carpenters Road, Stratford, London, E.15

SECOND ASSISTANT ENGINEER (Electrical)

required for a permanent and pensionable appointment in GHANA. Candidates should be between 25 and 31 years of age, have served a recognised apprenticeship, preferably in factory electrical maintenance, and have in addition a minimm of three years' practical experience.

They should also possess at least an Ordinary National Certificate (Electrical).

Please write with full particulars to the Personnel Officer.

6820

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER (Construction) required at No. 1 Sub-Area Headquarters, Liverpool. Salary within range £1,535/£1,720 per annum (N.J.B. M/7).

Applicants should have considerable experience in the construction of underground and overhead E.H.V., H.V. and M.V. distribution networks including substations and associated equipment, and should possess appropriate technical qualifications.

Appointment subject to medical examination. Pension scheme.

Special application forms obtainable from the Manager, No. 1 Sub-Area, 24, Hatton Garden, Liverpool, 3, should be returned not later than 30th November, 1960. 6817

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

GRADE 9 ENGINEER, EARLEY GENERATING STATION. Applicants should have had previous experience in a modern generating station. Manufacturing works experience will be an advantage.

Preference will be given to those who possess qualifications leading to corporate membership of a recognised professional institution or equivalent qualifications.

Salary N.J.B. Grade G.9, £965-£1,090.

Special application forms obtainable only from Divisional Secretary, 111, High Street, Portsmouth, should be returned by 8th December, 1960. 6843

A Capable, Intelligent

MANAGER

for Old-Estab. Elec. Wholesalers, Central London

This post is a very responsible one in rapidly expanding company and affords great opportunities for man of outstanding ability. It involves complete control of Order Dept., Stores and Transport. Successful candidate MUST HAVE INITIATIVE AND EXCELLENT MANAGERIAL RECORD.

Good salary and superannuation.

Write—Box 6866.

JOHNSON & PHILLIPS LIMITED

have vacancies in their
Rubber Cable Laboratory for :—

1. RUBBER TECHNOLOGIST required for work in rubber and plastic cable laboratory for the physical testing and dimensional control of rubber and plastic cables. Minimum qualifications L.I.R.I. or equivalent.
2. LABORATORY ASSISTANT, preferably with a knowledge of rubber cable manufacture, to assist in development and quality control of rubber and plastic cables.

Applications stating age, experience and training to Employment Manager, Johnson & Phillips Ltd., Victoria Way, Charlton, London, S.E.7. 6840

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS' ENGINEER (1) required in the Liverpool North District. Salary within range £965/£1,090 per annum (N.J.B. J/11).

Duties will include estimating and preparation of specifications for contracting work, and advising consumers on matters relating to electricity supply and the utilisation of electrical equipment. Applicants should possess suitable technical qualifications.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 1 Sub-Area, 24, Hatton Garden, Liverpool, 3, should be returned not later than 5th December, 1960. 6858

A MIDLANDS manufacturing firm needs a designer whose basic training has included light production engineering. Higher National Certificate standard in engineering and sound drawing office experience required. A knowledge of electric motor production is an advantage but not necessary. The applicant should have managerial ability so that at some future date he can take over a department. Please send full details of education and experience to—Box 6849.

APPRENTICES for electrical installation work. Openings for several intelligent and enthusiastic youths. Comprehensive training on sites, in office and technical schools. Write—Alliance Electrical, 2, Henrietta Street, London, W.C.2. 136

BEST & MAY Ltd., 345-347, Kennington Road, London, S.E.11, require an experienced order office clerk. One with sound experience on industrial electrical wholesaling. Salary commensurate with age and experience. Good hours, 5-day week. Progressive post in expanding business. 6756

CABLE jointers and mates required for long term contract work in the South Wales area. Jointers must be capable of working up to 11 kV and live L.V. mains. Generous overtime. London rates. Please reply to—Box 6877.

CABLES and flexibles. Sales clerk, semi-senior, required for customer liaison duties. Permanent progressive post. Write details positions held, present salary, in confidence, to the Secretary, Reliance Cords & Cables Ltd., Staffa Road, Leyton, London, E.10. 7671

DEVELOPMENT engineer and assistant engineer to take charge of a heater development laboratory, after a short initial period. Able to see design through from inception to quantity production with minimum supervision. O.N.C. (Electrical) minimum, but a higher qualification is desirable, together with some years' practical experience of small appliances and a sound knowledge of elementary physics. Assistant O.N.C. standard. Send details of qualifications, experience, positions held, present salary, etc., to the Personnel Manager, E. K. Cole Ltd., Malmesbury, Wilts. 6821

DRAUGHTSMAN or junior with experience of transformers up to 1,000 kVA required by expanding company in the London area. State experience, qualifications, age and present salary. Own staff informed.—Box 6835.

ELECTRICAL breakdown man required in January. Minimum rate 6s. 6½d. per hour plus 4-room flat accommodation in North London.—Box 188.

ELECTRICAL development engineer. West London company manufacturing electrical control equipment requires the services of an electrical development engineer. The applicant must have training to Higher National Certificate level or equivalent and a wide knowledge of installation detail applicable to motor control boards. He will be required to work on more advanced applications of circuit design and applied engineering relative to the uses of motor control gear within the industry. The position is a progressive one. Minimum age level 30; basic salary of £1,000 per annum will be offered. Pension fund, canteen facilities, etc. Please write giving full details of age, experience, qualifications to—Box 6738.

ELECTRICAL engineer required for Glasgow office staff, age 23 - 28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to—British Engine Boiler & Electrical Insurance Co. Ltd., 98, West George Street, Glasgow, C.2. 6848

ELECTRICAL engineering assistants. Two men with initiative required. Age 25 to 40, of good general education and up to H.N.C. technical standard. Duties to assist in planning extensions and modernisation of electrical plant from intake substations to production unit in a specialised branch of the steel industry in the Midlands. Drawing office experience and some knowledge of industrial electronics an advantage. Salary according to capabilities, four figures considered for the best man. Write in confidence details of training, experience, present duties, qualifications and salary required to Chief Electrical Engineer.—Box 6822.

ELECTRICAL wholesaler. Nationally known organisation require branch manager, Middlesex area. Experience essential. Salary, commission and expenses.—Box 6878.

Situations Vacant (continued)

ENGINEERS: Are you interested in joining a rapidly expanding progressive electrical company engaged on varied and interesting work, situated in pleasant surroundings, with bonus and non-contributory pension scheme? We are interested in obtaining keen engineers anxious to climb the ladder of success. If you have an intimate knowledge of circuitry apply to—M.T.E. Control Gear Ltd., Progress Road, Leigh-on-Sea, Essex. 6836

ESTIMATING, site supervising and design engineer required for high-class installation work of all descriptions. Permanency and good immediate prospects for keen and able engineer. Write stating age, experience and salary required to—Mr. C. King, Alliance Electrical, 2, Henrietta Street, London, W.C.2. 137

INSTRUMENT makers required, fully skilled and able to work to drawings and specifications. Apply, quoting ref. FD/527, to Personnel Officer, Decca Radar Limited, Shannon Corner, New Malden, Surrey. 6823

PLUMBER cable jointers H.V. and L.V. preferably with supply industry experience required for contracting work. First-class tradesmen only need apply.—Box 6879.

RAPIDLY expanding manufacturing electrical engineers require agent/representative for Lancashire and Cheshire with enthusiasm and drive.—Box 336.

REPRESENTATIVE required for a firm of London wholesalers (electrical) experienced and with good connections. Only men who can produce results need apply. This is a unique opportunity for the right man.—Box 6880.

SALES representative (trainee). Old-established electrical engineering company situated in N.W. London requires man with electrical engineering background to train as industrial sales representative. Knowledge of motor characteristics desirable. Superannuation scheme. Write giving full details of experience, age and salary required to Personnel Manager, Box SR.4261, A.K. Advg., 212a, Shaftesbury Avenue, London, W.C.2. 6824

SITE supervisors wanted for long term cable installation contract work in the South Wales area. Please reply to—Box 6876.

STOREKEEPER for electrical wholesalers; must be experienced.—W. L. Turner & Co., 64, Victoria Street, London, S.W.1. 6881

SUPERVISING engineer. Opportunity offers for young man of drive and initiative in an established and expanding electrical contracting business in N.W. London. Write full details of training and experience to—Box 184.

TECHNICAL assistant required for drafting of electrical regulations, codes of practice, etc. Graduate I.E.E. or corresponding qualification necessary, also experience in committee work and drafting of reports. Comm. salary of the order of £1,000, plus or minus an amount to be determined according to age, quals. and exp. Progressive post. Pension scheme.—Box 6815.

TECHNICAL representative required for old-established manufacturers' agents in the Midlands. Experience in the sale of light current electronic and servo components essential. Remuneration on the basis of salary, commission and expenses.—Box 6837.

WORKS manager required by switchgear factory in Scotland. Must be capable of developing organisation and taking full control. Excellent prospects offered to right class of man having switchgear experience. All applications will be considered in strict confidence by the Managing Director.—Box 6742.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

ADVERTISER seeks change from present executive position. Many years' experience in electrical wholesaling. Excellent connection in South-West area, industrial, contractors, stores, retailers. Would like to hear from reputable manf's with view to representation, agency.—Box 7674.

INDIAN engineer (31), recently trained by manufacturing company in electrical switchgears, transformers, A.C. and D.C. machines, etc., requires position.—Box 7675.

REPRESENTATIVE, electrical wholesale, some good connections, seeks change where good support is available; or with manufacturer considered. London area.—Box 7661.

WHOLESALER'S branch manager seeks change, with greater responsibility, remuneration, prospects, backing, perhaps working with smaller but growing concern, in responsible position with guaranteed prospects. London or near preferred. Could travel.—Box 7677.

ARTICLES FOR SALE

MOTORS

NEW CROMPTON PARKINSON, from ¼ h.p. to 80 h.p.; also 6,000 A.C. and D.C. reconditioned Motors and Starters.

IN STOCK HERE

B. E. WHITE
Brantwood Rd., Tottenham, London, N.17
Tel. EDMonton 4621-2 215

HOUSE SERVICE METERS

200-240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.
221, City Road, London, E.C.1 37

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd. London W4. 57

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish, vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 55/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 2234/5/6). 169

ALTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

ALTERNATORS for sale from 1,100 kVA at 750 r.p.m. down to ½ kVA. Single and three-phase. All voltages. More than 150 machines in stock. Automatic regulators and switchboards available.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 117

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT-breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors and generating equipment.—E. M. Tatton & Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 116

ELECTRIC motors, 1,000 in stock, half maker's prices.—Sugdens, Glenny Road, Barking (RIPpleway 3302). 7613

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

FLUORESCENT tubes reconditioned and guaranteed with a life as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks. Save 40% on your tube replacement costs by using this service. We are also manufacturers of top quality fluorescent fittings, trunking systems, control gear and new fluorescent tubes. Generous discounts available.—Anglo-American Electrical Company, Clive Street, Bury (Telephone, Bolton 7251). 212

FOR sale, good, unused and used machinery, including electric motors, A.C. and D.C. dynamos, alternators, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

GENERATING sets, portable or stationary, new and reconditioned, 1 to 100 kW, A.C. and D.C.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 148

KARDEX, Roneodex and Shannovue cabinets, as new.—F. H. Jolly & Co. Ltd., 289, King St., London, W.6 (RIV. 5381). 202

LABELS. Engraved laminated plastic labels for switchboards, etc. Quick service at reasonable prices. Send for price list to—Hereford Watch Co., 13, St. Owen Street, Hereford. 7673

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS and control gear, huge stocks all types, ¼ to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (5444/7). 70

NAMEPLATES, engraving, diesinking, stencils.—Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PREPAYMENT 1s. slot house service meters.—Universal Electrical, 217-221, City Road, London, E.C.1. 36

PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switchholder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. F. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

QUARTERLY credit meters, single and polyphase, 2½-100 amps. From 20/-. Also D.C. See Television.—Tradex, Surbiton. 171

ROTARY converters in stock, all sizes; enquiries invited.—Universal Electrical, 221, City Road, London, E.C.1. 34

SET 54-cell type SSYRS sealed batteries, 40-amp. hour capacity. 7-h.p. Petter engine in good condition, runs on paraffin. Reasonable offer considered.—F. Barnes, Moscar Edge, Nr. Sheffield, 6 (Phone 31969). 6884

SMALL BR screws and nuts in steel, brass and stainless steel, from stock.—Premier Screw & Repetition Co. Ltd., Woodgate, Leicester. 180

TELEVISION slotmeters and time switches. Details from: Tradex Meter Co., Surbiton (Elmbridge 2234/5/6). 172

TRANSFORMER by Hackbridge, input 6,600 volts, output 415 volts; 200 kVA. Oil cooled.—East & Son Ltd., Berkhamsted (Tel. 2255). 6838

VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generating sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

40/20-h.p., 950/480-r.p.m. Lancashire T.E.F.C. slipring motor with Igranic automatic control panel giving 2-speed control forward and reverse, 415 volts, 3-phase, 50 cycles. Details from—Dynamo & Motor Repairs, North End Road, Wembley Park, Middx. 90

108-kW motor generator by E.C.C., output 57/67 volts, 1,900/1,615 amps. D.C., with 165-h.p. slipring motor, 585 r.p.m., with starter for 400 volts, 3-phase, 50-cycle supply. Two sets available. Details and price with guarantee from—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park, Middx. 88

180-h.p., 970-r.p.m. T.E.F.C. slipring motor by Lancashire, 400 v., 3-phase, 50 cycles, complete with fully automatic starting panel. Further details from—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park. 77

188-kW motor generator by Crompton Parkinson, output 67/90 volts, 2,440 amps. D.C., with 280-h.p., 580-r.p.m. slipring motor, with starter for 400/440 volts, 3-phase, 50 cycles. Two similar sets available for single or parallel operation with switchgear and meters. Details from—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park, Middx. 89

400-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 27

500-kW, 220-volt Met.-Vick. rotary converter, with transformer, 11,000 volts, 3-phase, 50 cycles, and accessories.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 17

500/625-kW L.D.C. generator, 240 volts, 2,080/2,600 amps., D.C., compound interpole with single bearing for direct coupling at 1,000 r.p.m., or on combination bed with new L.D.C. slipring motors, 900 h.p., 990 r.p.m., 3.3 kV or 6.6 kV, complete with switchgear, in approximately six months. Also duplicate generator and spare armature. Further details from Dynamo & Motor Repairs Ltd., North End Road, Wembley. 84

705-kVA Crossley diesel alternator set, 400/3/50, complete with switchgear.—Box 6882.

EQUIPMENT FOR HIRE

GENERATING set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW, diesel or petrol, stationary or mobile, sale or hire. 24-hr. breakdown service.—Dawson-Keith Ltd., Hillview Rd., Sutton, Surrey (Fairlands 4401). 46

ARTICLES WANTED

A.C./D.C. electric motors, generators, transformers, disused stocks of cable, power houses bought and dismantled.—Samuel Hyams, 129, Lambs Lane, Rainham, Essex (Rainham 4896). 125

ELECTRIC motors, 230/1/50, 1, 1½ and 2 h.p. Must be fully tropicalised. Bulk quantities required at clearance prices.—Box 6883.

WANTED

D.C./A.C. Motors, Transformers, Cables and all redundant Power Station plant wanted for dismantling.

ASK US TO QUOTE

B. M. T. CO. LTD.
London Road, Barking
(RIP. 3387/3715)

298

HARRINGTON & Sons, reclamation contractors, want redundant A.C./D.C. electric motors and transformers, stocks of cable, etc.—109, Beaconsfield Street, New Beckton, East Ham, London, E.6 (ALB. 1388). 315

QUICKSILVER and beryllium copper scrap urgently required, best prices, prompt cash. Sterling Products Ltd. Edmonton 4541 PBX. 293

SILICON steel offcuts required.—Box 138.

WANTED, D.C. and A.C. ball-bearing motors, motor generator sets, dynamos and alternators. Full details to—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 13

WANTED for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London, E.1. 120

WANTED, rotary converters, any sizes.—Universal, 221 City Rd., London E.C.1. 35

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

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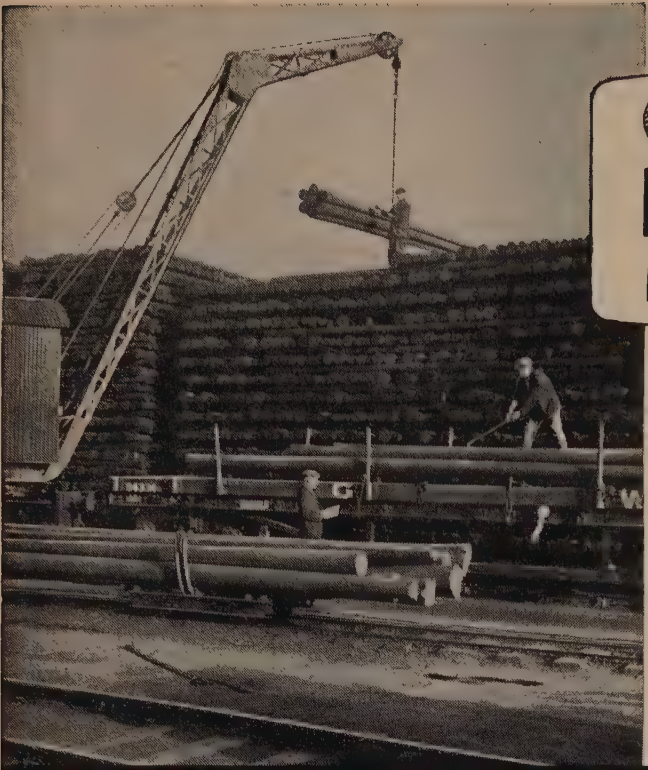

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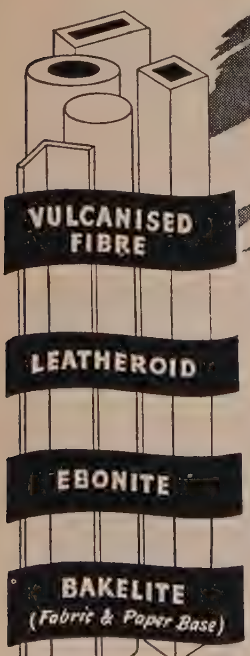

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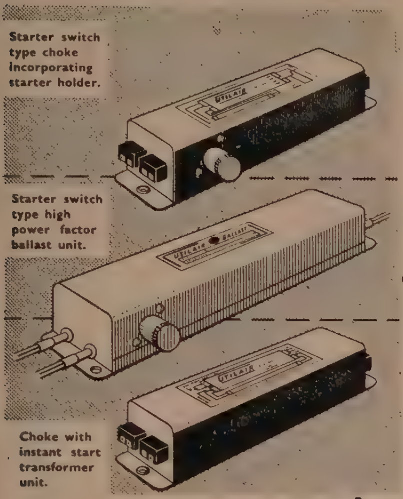
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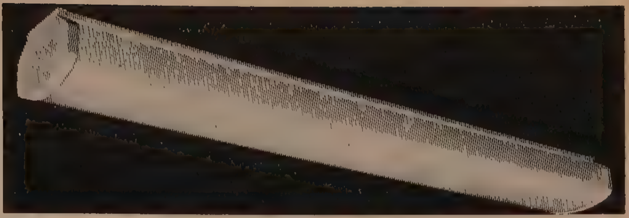
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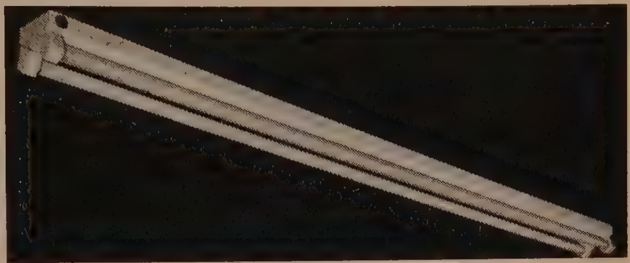
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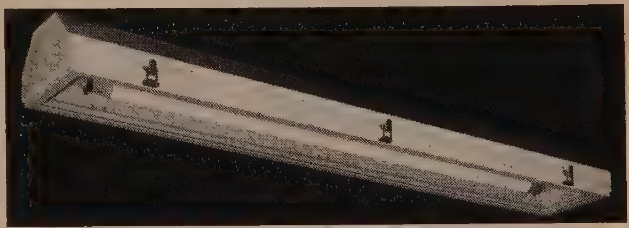
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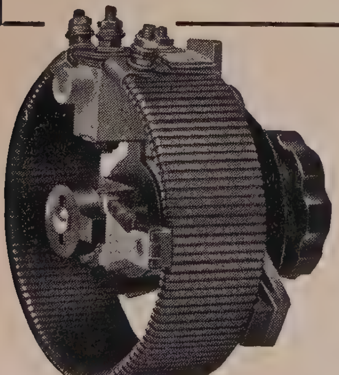

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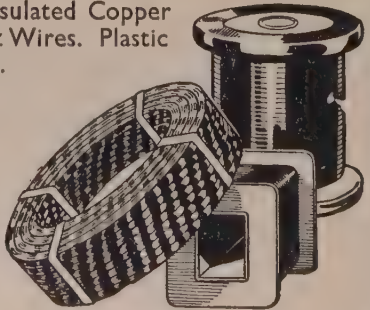

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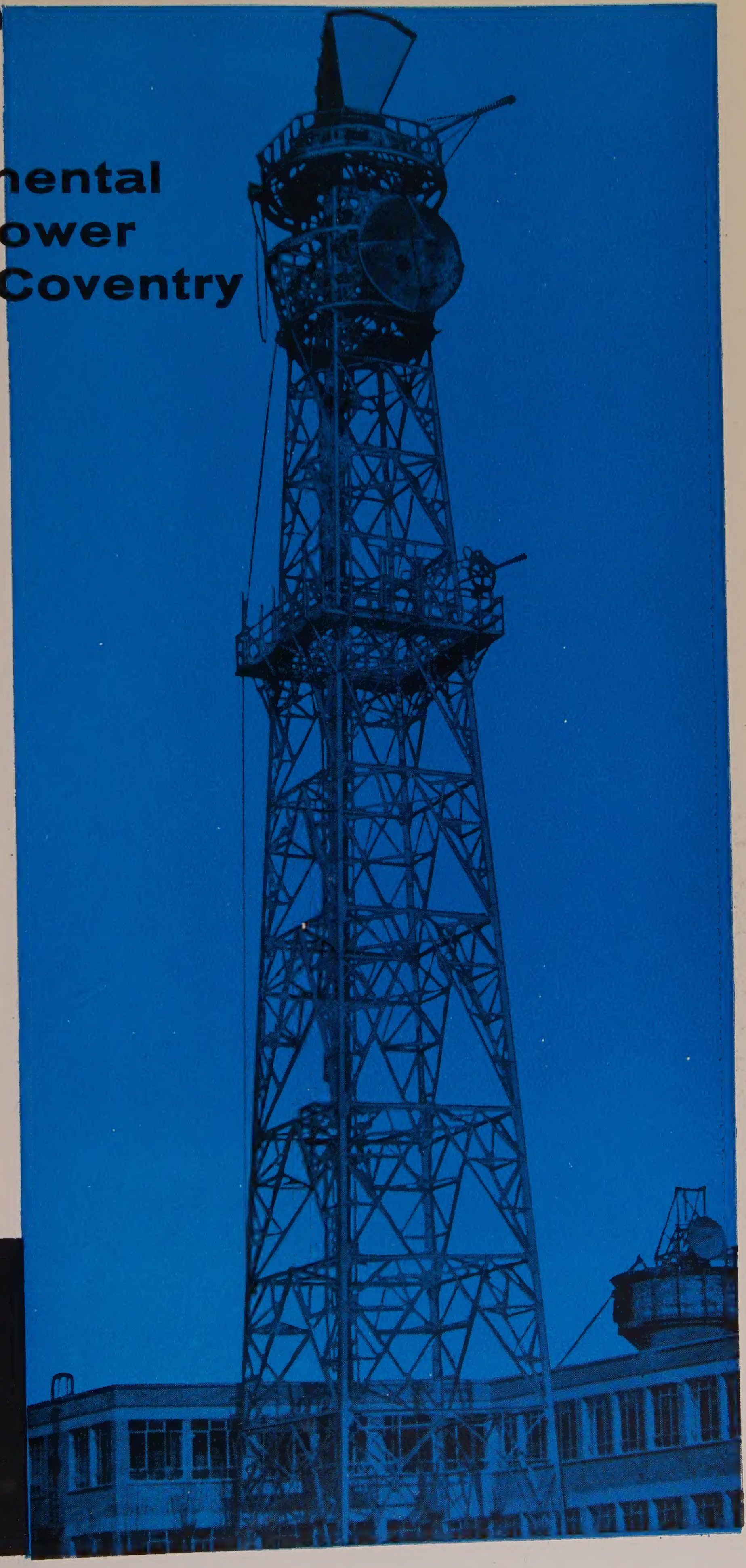

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